FILE DESCRIPTION

NEW YORK FILE

Bulky Exhibit

ABRAHAM

SUBJECT BROTHMAN

FILE NO. 100-95068

VOLUME NO. 1B

SERIALS 101

thru

160

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JULIUS ROSENBERG, et al.

NEW YORK BULKY EXHIBIT FILES

ABRAHAM BROTHMAN 100-95068 1B

Exhibit Number	Description	Released	Denied	Withheld
101	NOTES ON ARTICLES appearing in MOSCOW MAGAZINE (1940)	✓		
102	Trial Brief	✓		
103	employment application & related papers of 3rd party			destroyed 2/13/52
104	affidavit			destroyed 2/12/52
105	Charge to jury			destroyed 2/12/52
106	Court documents			destroyed 2/12/52
107	A. Brodman's Supplementary Court proceedings			destroyed 2/12/52
108	Copy of letter to Saypol			destroyed 2/13/52
109	Brodman appeal			destroyed 9/25/57
110	letter	✓		
111	letter from Brodman	✓		
112	Return to Writ of Habeas Corpus, + affidavit	✓		
113	letter from Brodman	✓		
114	letter from Brodman	✓		
115	letter from Brodman	✓		
116	copy of essay	✓		
117	letter from Brodman	✓		
118	letter	✓		
119	treatise	✓		
120	letter from Brodman	✓		
121	letter (2 copies) + misc. pages	✓		
122	Copies of technical writings	✓		

JULIUS ROSENBERG, et al.

NEW YORK BULKY EXHIBIT FILES

Abraham Brothman 100-95068 1B

Exhibit Number	Description	Released	Denied	Withheld
123	copies of technical writings	✓		
124	2 copies of memorandum	✓		
125	2 letters from Brothman	✓		
126	2 copies of thesis and 2 copies of drawing	✓		
127	Circuit Court of Appeals	✓		
128	copy of "Drawing 1"			TOO LARGE
129	Copy of "Drawing 2"			TOO LARGE
130	copy of drawing of T.V. tube			TOO LARGE
131	Copy of "Drawing 3"	✓		
132	Copy of "Drawing 4	✓		
133	Copy of "Drawing 5	✓		
134	copy of paper on CR Tube			TOO LARGE
135	copy of envelope	✓		
136	Copy of "Drawing 6"	✓		
137	copy of "Drawing 7"	✓		
138	CR Tube Drawing 6			TOO LARGE
139	CR Tube Drawing 7			TOO LARGE
140	2 copies of CR Tube drawing, drawings 4 & 5			TOO LARGE
141	2 copies of letter	✓		
142	Errata, Addenda, & comments	✓		
143	Miscellaneous notes	✓		
144	Drawing 8	✓		TOO LARGE

A. B. Migdal. Investigation of atoms of pair creation in the course of nuclear reactions

A. I. Leipunsky - Fission of the nuclei

V. Perfilov - Observation of tracks of recoiling nuclei arising in the course of uranium fission under the neutron bombardment in the Wilson chamber work

3

under Covered passage

K. Petrzak. Range and energies of fragments of uranium fission caused by fast neutrons

V. G. Khlopin - Chemical Nature of uranium fission products

S. N. Flerov & L. I. Rusinov Experiments on fission of uranium

K. O. Sinelnikov - A. K. Walter
& A. V. Ivanov. Calorimetric
measurements of the radiative
energy losses for fast
electrons in the lead.

L. A. Arcimovich & M. Bredov -
The "Bremsstahlung" of
fast electrons

M. O. Borisov, V. Bratchenky
V. D. Leipunsky - The
scattering of fast electrons
by nitrogen nucleus

[illegible] Frankel. The pair
[illegible] tion in nitrogen by
[illegible] mma [illegible]

I. Veksler & D. Timo-
shchuk - Absorption
of fast neutrons

I. P. Bobo Borodko &
D. I. Leipunsky -
Scattering of photo-
neutrons of diffe-
rent energies by
atomic nuclei

I. V. Kurchatov -
On the Operation of
the Rad. Inst. of the A. S. of Sc.
of USSR Cyclotron

FD-141
(7-1-48)

BULKY EXHIBIT

Date received 11-13-50

ABRAHAM E. OTTMAN

100-25068-1B
(Title of case)

Submitted by Special Agent JOHN M. COLLINS

Source from which obtained IRVING H. SAYPOL

Address USA, SDNY

Purpose for which acquired INVESTIGATION

Location of bulky exhibit IN CABINET WITH FILE

Estimated date of disposition TO BE DECIDED AT CONCLUSION OF CASE

Ultimate disposition to be made of exhibit RETAIN

List of contents:

102. Trial Brief used by USA Saypol in Subject's trial.

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100-9 5068-1B

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ROUTED TO | FILE

Title 18, Sec. 1503, United States Code (1946

"Whoever, corruptly, or by threats or force, or by any threatening letter or communication, shall endeavor to influence, intimidate, or impede any party or witness, in any court of the United States or before any United States Commissioner or officer acting as such commissioner, or any grand or petit juror, or officer in or of any court of the United States, or officer who may be serving at any examination or other proceeding before any United States commissioner or officer acting as such commissioner, or shall injure any party or witness in his person or property on account of his attending or having attended such court or examination before such commissioner or officer, or on account of his testifying or having testified to any matter pending therein, or who shall injure any such party or petit juror in his person or property on account of any verdict, presentment, or indictment assented to by him, or on account of his being or having been such juror, or who shall injure any such commissioner or officer in his person or property, on account of the performance of his official duties, or who corruptly or by threats or force, or by any threatening letter or communication, shall influence, obstruct or impede, the due administration of justice therein, shall be fined not more than $5,000 or imprisoned not more than five years, or both." (Mar. 4, 1909, ch. 321, 35 Stat. 1113; June 25, 1948, ch. 645, 62 Stat. 769.)

STATEMENT

The following (R. [illegible]) charges that from on or about the [illegible] day of [illegible] and continuing up to and including the 12th day of [illegible], 1950, in the Southern

[illegible] Irish
[illegible] Gold, and Henry Gold, a
[illegible] Lewin, and divers
[illegible] unlawful
[illegible] conspire,
[illegible] with each other,
[illegible] the execu-
[illegible] enforc-
[illegible] America,
[illegible] the Administra-
[illegible] Title 18,
[illegible].).

[illegible] said defendants will hear, during
[illegible] of the United States, duly
[illegible] Southern District of [illegible], was conducting
[illegible] activities of [illegible] and of the espionage
[illegible] and others.

[illegible] conspiracy that the
[illegible] common-
[illegible] explanations of
[illegible] other pers-
[illegible] said conspiracy
[illegible] appeared befor

[illegible] and [illegible] and [illegible] additional information concerning the [illegible] conspiracy.

[illegible] and [illegible] said conspiracy [illegible] the defendant, [illegible], would [illegible] marry [illegible], a communication [illegible] the substance of an [illegible] testimony to be [illegible] [illegible] for the purpose of enabling the said Lucy Gold to [illegible] [illegible] testimony thereto.

[illegible] further [illegible] said conspiracy [illegible] Lucy Gold [illegible] while the aforesaid Grand Jury, by said false, fictitious, fraudulent and [illegible] information [illegible] the aforementioned [illegible], which would [illegible] the [illegible] information [illegible] to said Grand Jury by the defendant, [illegible].

Overt Act

[illegible] the [illegible] of said conspiracy and to effect [illegible], at the Southern District of New York [illegible] [illegible], testified before the aforesaid Grand Jury, as to what the 22nd day of July, [illegible] [illegible] [illegible] of said conspiracy, [illegible] [illegible] [illegible], at the Southern District [illegible] [illegible] said testified before the aforesaid [illegible] [illegible] that the 31st day of July, 1947.

- 5 -

- 6 -

Identify (
Moskowitz
in office.

I then took the telephone and spoke to a man, who [illegible] following conversation:

I [illegible] to whom I had the pleasure of speaking?

I told him that I was a representative of the United States Government. He then in official [illegible] business that he wished to speak to him about.

He said that he could be down in 15 or 20 minutes, but he advised him he would wait in his office until he arrived there.

Approximately one half hour later, at about [illegible] Mr. Markham entered his office and he took him into a private conference room where he wished to discuss with him privately.

I first identified myself by handing to him my official credentials, stating that I was a Special [illegible] of the FBI.

I then requested that Markham to step out of the room and [illegible] on [illegible] I would be back with another [illegible] desk occupied by the [illegible].

I then handed a photograph of Dean Hall to Mr. Markham, and asked him to identify the same. He stated both Markham Hall and photograph was a [illegible] he asked her wasn't whether the picture to [illegible] he would identify it for us.

Identi
pictu
Dolos
playe
broth

He looked at the picture for a period [illegible] and then advised he had [illegible] and said he did not know him.

I then showed him a picture of Elizabeth Bentley. He identified the photograph as that of Miss Bentley but again stated, should [illegible] he would be unable to identify it.

- 2 -

[illegible] that three [illegible] Harry Gold was [illegible] Harry Gold [illegible] Harry Gold.

Identify picture of [illegible] Gold.

[illegible] of the F.B.I., [illegible] and told him that [illegible] confidential matter. [illegible] office, or any other [illegible] interview.

[illegible] and there was no [illegible] interview. It was [illegible] our automobile, [illegible] the laboratory. [illegible] proceeded to the [illegible] the laboratory. [illegible]

[illegible] to hold the [illegible] not identify this photo- [illegible] or in the [illegible] for about [illegible] he knew that [illegible] he knew under the name [illegible]

[illegible] individual and the [illegible] He then stated [illegible] this man, or the [illegible] Doctor [illegible] the American [illegible] of Philadelphia, [illegible] concluded, he and the [illegible] restaurant in midtown [illegible] in business [illegible] Bill [illegible]

[illegible] (or Golden) made a [illegible] to [illegible] engineer in [illegible] appointment to [illegible] to discuss [illegible] also to obtain [illegible] to [illegible] chemical [illegible] to evaluate the [illegible]

[illegible] after we entered the laboratory, Jerry Cole received a telephone call. He did not tell us who called him, and we were unable to ascertain the substance of this telephone conversation.

After writing out the signed statement it was shown to Jerry Cole. He was asked to read it, to see if it substantially reflected what he had told us in the course of the interview. He said the statement was correct, was a true statement of the facts. He was asked if he had any objection to signing the statement. He stated he had no objection. He then signed each page and the last page of the statement in the presence of myself and Agent O'Brien.

At about 9 PM the interview was concluded, and Agent O'Brien and I proceeded to the FBI headquarters in New York City.

[illegible]

The grand jury in the judicial [illegible] criminal court records which indicate that a grand jury was duly empaneled in this court on June 16, 19[illegible] by an order duly signed by the Honorable John C. [illegible] on June 5, 19[illegible], and that this grand jury was discharged on December 1[illegible], 19[illegible].

I [illegible] Washington Avenue. My occupation is that of a [illegible] Grand Jury Reporter. I have been so employed since [illegible], 19[illegible], and was so employed on July [illegible], 19[illegible]. On July [illegible], 1[illegible], I reported the testimony of Wrotham Brotheram before the Federal Grand Jury, before Mr. Brotheram was testifying. I did not take all the testimony. I started Mr. Brotheram's testimony and was relieved by Mr. [illegible], a Grand Jury Reporter. I started typing Mr. Brotheram's testimony to final form immediately after reporting it. I have my original notes. Exhibit [illegible] for identification is the original transcript of Mr. Brotheram's testimony of July 22, 1949. Exhibit [illegible] is my original notes that I took then on July 22, 1949. They have not been changed in any way. Exhibit [illegible] is a portion of Mr. Brotheram's testimony of July 22, 1949 which I reported and typed. I have compared my original notes correctly. I have compared them with [illegible] transcript. It is an accurate and true transcript of Mr. Brotheram's testimony.

I will now please hand the transcript to the ladies and gentlemen of the jury [illegible] through [illegible] for their [illegible].

I reside at [illegible] 24th Street, Brooklyn, New York. I am employed by the Grand Jury Reporters. I have been so employed for the past twenty years. I was so employed in July, 1947. On July 22, 1947, I took a portion of the testimony of Archer Brockman. I can identify Mr. Brockman. Exhibit A contains my original notes taken on July 22, 1947. After I recorded Mr. Brockman's testimony, I made a transcript on the same day that I recorded his testimony in shorthand. Exhibit A is a true and accurate transcript of Mr. Brockman's testimony in portion that I have taken.

Will you please read it to the ladies and gentlemen of the jury.

I recorded the testimony of Harry Cole on July [illegible] 1947. I can identify Mr. Cole from pictures. Mr. Cole's testimony is contained in Exhibit A. It has never been changed. I made a transcript directly after recording Mr. Cole's testimony. It is a true and accurate transcript of Mr. Cole's testimony.

Will you please read it to the ladies and gentlemen of the jury.

ex

[illegible]

I, [illegible], certify:

My residence is 23 West 86th Street, New York City.

I was graduated from East High School, Rochester, N. Y.; from Vassar College, Poughkeepsie, N. Y., with an A.B. Degree in 1930; and from Columbia University, New York City, with a Master's Degree, in January, 1935.

From 1930 to 1932 I taught at the Foxcroft School, Middleburg, Va. I taught French, English and Italian.

I studied on an exchange fellowship at the University of Florence, Italy, academic year 1932 - 1933.

After I obtained my Master's Degree from Columbia in 1935, I was an investigator for the [illegible] of the City of New York for about five or six months.

ebr

Elizabeth T. Bentley

In March 1935 I joined the Communist Party.

From 1935 to 1938 I was a member of the Communist Party, attended Communist Party unit meeting, and carried on the task which the Communist Party gave me.

In July of 1938 I obtained through the Columbia University Placement Bureau a position as secretary and research worker in the Italian Library of Information, which was the American branch of the Italian government's Propaganda Ministry. As a result of taking that position I was told to go underground.

As a result of instructions from the Communist Party's National Headquarters, I was removed from my unit and put in contact with one man. This man was Jacob Golos.

Identify pi of Golos.

I obtained copies of all documents, letters, pamphlets that were being put out by the Italian Library of Information.

Identify L

[illegible] assignment to receive blueprints [illegible] to J. Golos

as representative of the Communist Party.

To the best of my recollection, I met Brothman for the first time in a Chinese Restaurant located on West 32rd Street between 6th Avenue and 7th Avenue.

I was taken there by Mr. Golos in the early part of 1940. It was around the late dinner hour.

Golos had been dealing with Brothman before but I do not think he ever told me how long.

Mr. Golos introduced me to Mr. Brothman by the name of Helen - no second name.

Mr. Brothman was introduced to me by his real name, Abraham Brothman.

Brothman referred to Golos as John.

I was Helen. Brothman was Abraham Brothman. Golos was John.

Mr. Golos told Mr. Brothman that from then on I would sometimes take his place to collect the material which Mr. Brothman was bringing Mr. Golos.

[illegible] was told that Mr. Brotman would be [illegible] an [illegible] which I was to accept and pass on to him, in Brotman's presence.

This was done and Brotman was told to make arrangements for the next meeting.

Mr. Brotman also was to pay his Communist Party dues to me. Mr. Boles told Mr. Brotman to pay his Communist Party dues to me.

Mr. Boles told me Brotman was a member.

At a prior occasion Mr. Brotman also told me that one of the Mr. Brotmans commenced paying [illegible] Communist Party dues to me.

[illegible] will be approximately from early 1950 until [illegible].

[illegible] difficulty experienced to get him to pay his [illegible] dues from him but the receipt of same from [illegible] during this interview.

In the night of my visit regarding the Lubman instruments on each visit I asked Mr. Brotman and I arranged for a future appointment. It is my recollection we were to meet there a week or two weeks later, at the same place on Hollywood Blvd. one evening.

(At these meetings) we Usually first had dinner and talked about inconsequential things.

He would discuss the weather. Then very often Mr. Brothman would ask questions on Communist Party tactics and problems which I would answer. Then he would hand me an envelope containing material he had sometimes. He would explain problems which he had in connection with the material.

Sometimes Mr. Brothman had brought a duplicate of blueprints which we could keep. Sometimes Mr. Brothman had the original blueprint and it was necessary for me to take it to the blueprint shop and have a copy made and return the original to him at the next meeting.

The blueprint that I looked at were what he described to me as kettle or kettle drums.

Mr. Brothman tried to explain in technical terms what he was doing.

I am not a chemist or engineer.

Mr. Brothman asked me twice. He was going to be in

[illegible]

[illegible] before a [illegible] in connection [illegible] Professor [illegible] and I have several [illegible] to [illegible] and [illegible] he has [illegible] [illegible] the [illegible] because [illegible] Professor [illegible] I was sufficiently technically [illegible] to understand what his work was about. He kept insisting that we be in contact with someone [illegible] could easily [illegible] details.

Mitchell L. Rankin

I explained John about Prothman's dissatisfaction with my lack of technical qualifications.

I reported that to John.

I received such instructions.

I did discuss that with Prothman.

I told Mr. Prothman he was to be put in contact with a technical engineer who could understand and discuss the problems with him.

Mr. Prothman said he did not want to be put in contact with anybody else. He liked the arrangement as it was. He actually reversed his stand. I asked him why. He avoided the question and said that he had gotten to know both John and myself and, by nature, he would prefer to be with people he knew rather than with strangers.

I had another conversation with Mr. Colos. As a result of the conversation with Mr. Colos, I went back and told Mr. Prothman that he must be carried over as another contact. I told him that he, himself, had complained that he wasn't dealing with a technical [illegible] and that I was technically competent, and that

Mr. Coles now felt that he should be in direct contact with an engineer. When Mr. Prothman continued to protest, I informed him that he was a good Communist, that good Communists followed orders without complaining, and that the party would regard him as a bad party member if he continued to behave that way. He halfway acquiesced and said he would think it over.

It is my recollection that even after three meetings Mr. Prothman still refused to be turned over to another contact.

[illegible] meeting, when I had failed to get a commitment from Mr. Prothman that he would [illegible]. I had another conversation with [illegible] details of that conversation, a [illegible] between all three of us - Mr. Coles, [illegible].

[illegible] would hold either of that [illegible] engineer. Mr. Coles [illegible] that [illegible] enough nonsense and [illegible] that Mr. Prothman be turned over [illegible] the technical knowledge to deal

with him. When Mr. Brothman again demurred, Mr. Golos said to immediately tell him that good Communists did not behave that way, that as a good Communist he should take orders and not ask questions." As a result of that, Mr. Brothman agreed to the re-assignment.

Mr. Golos told Mr. Brothman that I would at the next meeting explain the arrangements through which he would be turned over to the new contact.

The next meeting took place a week or two later. Before this meeting, I had another conversation with Mr. Golos.

At this next meeting, I asked Mr. Brothman for the license number of his automobile, explaining that he would be contacted by an unknown man, explaining that I could give him no details of the man, as to the appearance of the man who was to contact him, but that the man in question would have a complete description of Mr. Brothman, that he would have the license number of his automobile, and that it was to be arranged for Mr. Brothman to bring his automobile, [illegible] Park. He replied at giving me the license

number of his car, demanding why I wanted it. I explained to him he would make contact with his new man by his automobile and, therefore, it was urgent for him to bring his car into New York. First he wanted to know why he had to lose the new contact in his automobile, why it was that I or John could not personally bring the new contact to introduce him. I explained to him that that was the way things were done, and he finally gave me the license number. I could not remember the license number for two minutes. I wrote the number down on a piece of paper. I gave the piece of paper to Mr. Golos. I had a conversation with Mr. Golos before my next meeting with Brothman.

At my next meeting with Brothman, I told him to bring his car into New York, to park on a cross-town street, either 27th or 28th Street, between Seventh or Eighth Ave., in the evening, that he would be approached by a man whom he did not know, whose description I could not give to him, which man would get into the right-hand side of the front seat, and would identify himself to Brothman by saying that he brought records from Helen. Helen was the only name by which I was known to Brothman.

Brothman spoke later on to me concerning this
[illegible] contact could not be worked, and I said, no.
It seemed to be turned over. I gave him the same old
[illegible] line that it was too much of the Silver-
[illegible] being turned over -- it was his duty as a Communist
to follow orders in this, however, I was quite sure
[illegible] very busy with his new contact since
they both had/[illegible] background. That was not
[illegible] I had with Brothman.

[illegible] contact by telephone.

[illegible] for Brothman to be turned over to
[illegible] in the early fall of 1941.
[illegible]

[illegible] I knew Brothman and
[illegible] went up to Brothman's
[illegible] Brothman's office. I do not
[illegible], and I never knew
[illegible]. I was paid on the
[illegible] in New Jersey.

[illegible] Jake's security. John
[illegible]

HARRY GOLD

will testify as follows:

My name is Harry Gold. I reside at 6823 Kindred Street, Philadelphia, Pennsylvania.

I have been charged with conspiracy to commit espionage for the Soviet Union.

I entered a plea of guilty on July 26, 1950, and am in custody awaiting sentence. The date for sentence has been fixed for December 7, 1950, before Judge James P. McGranery in Philadelphia.

I have been charged with conspiracy to commit espionage with one David Greenglass.

The status of my case, as far as I am concerned, I believe I am supposed to plead to that case on December 4th.

There are no other charges pending against me.

No promise or offer of any kind, directly or indirectly has been made to me in connection with these crimes and no consideration for my testimony here as a witness has been made to me by anyone.

I was born on December 12, 1910, in Berne, Switzerland.

My family name was Golodnitsky, but my father changed to Gold.

My family came to the United States in July, 1914. We arrived at Ellis Island and there were a series of misspellings of the Golodnitsky name on several of the immigration papers and, in the resultant confusion, we were almost not admitted to the United States. The name was officially changed by one of the Immigration Officers at Ellis Island, who made the suggestion to my father.

From New York City we went to Little Rock, Ark., and, after a very brief stay there, we settled in Chicago for a period of nine to ten months.

From Chicago we moved to Philadelphia, Pa., in the Spring of 1915.

I am a citizen. I became naturalized on my father's papers in 1922. My father is a carpenter and a cabinet maker. He lives in Philadelphia with my brother at the address I have given.

I attended the Shaerwood School in Philadelphia until 1925. Then I went to the South Philadelphia High School, graduating from there in the Summer of 1930. In September, 1930, I entered the University of Pennsylvania. I left the University in March, 1932. Until June, 1936, I was a student in the Drexel Institute, taking a course in engineering. I received my diploma in June of 1936.

From September, 1938, to June of 1940, I attended Xavier University in Cincinnati, Ohio. I received my degree - cum laude.

At various times from 1936 up until the end of 1940, I took various technical courses in the field of chemistry and also additional courses in psychology. I hold the degree of Bachelor of Science in chemistry.

In the matter of my employment for after my graduation, and while in school in the summer of 1928, I worked for a short period in Philadelphia from September, 1928, to December of that year - a wood-working concern.

From January, 1929, until September, 1930, I was employed by the Pennsylvania Sugar Company, working in their laboratories as a routine chemist.

MEDICAL

From April of 1932 until December of that year I was employed again by the Pennsylvania Sugar Company in the distillery division.

From February 1933 to September 1933, I worked in Jersey City, New Jersey, for the Hallbrook Manufacturing Company - a soap concern.

In September, 1933, I returned again to the Pennsylvania Sugar Company, but, this time, in the refinery division. I remained there until August, 1935.

In July of 1940, after my leave of absence to attend Xavier University, I again returned to the Pennsylvania Sugar Company and remained there until February of 1946. I not only worked for the refinery, but for various subsidiaries of the firm.

From May, 1946, to June of 1948, I worked for the firm of A. Greenman & Associates in New York.

From September, 1948 up until May of 1950, the date of my arrest, I was employed at the Philadelphia General Hospital in the Heart Station doing research on cardiac disease.

This completes the record of my employment.

[illegible] (continued)

In or about 1933 while employed by the Holbrook Mfg. Co., a friend of mine in Jersey City, and the man who had obtained the job for me, invited me to attend some Party meetings of the Communist Party in Jersey City. In addition, he urged me to attend the Communist Workers' School in New York City, in the area of Union Square, and I did make inquiries there.

I have never been a member of the Communist Party.

The first time I began to engage in espionage for the Soviet Union was in the Spring of 1935. As a result of a series of conversations with the man who obtained for me the job at the Holbrook Mfg. Co., we began to establish the methods of manufacture of various industrial solvents from the Pennsylvania Sugar Co. It was at this time that I was employed in the Spring of 1935. These solvents are used in thinners for lacquers and varnishes.

From the Spring of 1935 until February of 1946, I was actively engaged in the transmission to the Soviet Union of information on various industrial processes and other data on various military matters.

I conveyed the information in the form of written reports, blueprints, samples of various materials which were given by me to various men who identified themselves to me as Soviet agents working under cover in this country.

There was a definite procedure for effecting the identification of a Soviet agent. This procedure usually consisted of a mutual exchange of recognition signs and words of mutual identification on the part of both the Soviet agent and myself.

For the first five years of my work for the Soviet Union, my function was that of supplying information which I had myself obtained. Thereafter, I functioned as a courier in which I transmitted information from various people working in the United States to agents of the Soviet Union.

I began to function as a courier in September of 1940.

HARRY GOLD (continued)

There were several contacts. In 1940 I began to work with a Soviet agent whom I know only as Sam.

IDENTIFY picture.

I met a man whom I knew as Sam and whom I met in May of 1940, who identified himself to me as a Soviet agent doing espionage work in behalf of Soviet.

I can identify Abraham Brotman.

Identify Brotman

The circumstances when and under which I met Abraham Brotman were:

As a result of a conversation with Sam, during the middle of August, 1941, I came to New York early in September to meet Sam. We arranged to meet on September 22, 1941. Again the proposed meeting with the chemical engineer did not take place.

As a result of the conversation with Sam on September 22, 1941, a series of details concerning a proposed third meeting were arrived at. These details I noted on a small white card.

I distinctly recall the following points: A meeting was to be between Sixth and Seventh Avenues, somewhere in the high twenties. The man whom I was to meet was in a car parked on the south side of the street. The car was to have a license number which contained among the figures a capital "J".

I was to open the door of the car and tell the man I bring regards from Helen. Also, I was to ask the man in the car about how his wife was. I do not remember his wife's name.

There were other details on the card, but these I cannot recall. I do remember that I noted the details on a white card which I had in my pocket at the time I received these instructions.

On the night of September 22, 1941, I came from Philadelphia to New York and went to the appointed street between Sixth and Seventh Avenue and in the vicinities. Some fifteen minutes after the time I had been told, a car came along. I referred

WITNESS

to my card and checked the license number. It was exactly as I had written it a week previous. I then opened the door of the car. She did not scream, exactly, but became excited when I gave him the rest of the previously prearranged recognition signals concerning regards from Alvin and the question about his wife.

In addition, while I do not recall the exact words, and the exact nature of the remainder of the recognition signals, I followed out faithfully the instructions which I had written on the card.

[illegible] (continued)

When I got into the car I introduced myself as Frank Baehler and the man in the car said that he was Abe Brothman.

After we had listened to the fight on the radio for about 20 minutes, Brothman drove the car a short distance to Bickford's Restaurant, which is either on 6th or 7th Avenues, somewhere between 39rd and 42nd Streets. We went into Bickford's Restaurant.

There was no conversation while we were driving to the restaurant because the ride was extremely brief. I think that everything took place in the Bickford Restaurant; I recall a very short ride.

In the Bickford Restaurant, Brothman asked me about a woman called Helen, whom he identified as a person to whom he had previously given technical data, data intended for transmission to the Soviet Union. He also spoke about Helen's predecessor, a man called John.

Brothman stated that he had gotten along much better with John than he had with Helen.

He also said that he was very pleased to have met me since I had identified myself as a chemist, and he felt that because of the fact that we were both technical men, as opposed to the point that Helen was not, that he could again begin funnelling information to the Soviet Union.

I never met either Helen or John at that time or afterwards.

Brothman told me that he was employed by the Hendricks Mfg. Co. of Carbondale, Pa. and New York City. He said that he worked in an office downtown on Church Street. He gave me the address of the firm and also the telephone number. All that I recall about the telephone number is that the exchange was Barclay 7.

Brothman went into great detail concerning his personal education and industrial background. As a matter of fact, this narration consumed the greater part of the 3 hours during which we spoke.

I told Brothman that I was a chemist and that I did not live in New York. I told him that I was married and had a wife and two children, twins. I did not identify the city where I lived nor the firm for which I worked. I made this statement on direct orders. He did not ask me where I lived.

The third event of the evening was that an arrangement was made between Brothman and myself for a second meeting to take place, some 10 days hence.

This meeting was to take place inside of a Child's restaurant on the west side of Columbus Circle, and was to be at about 8 o'clock in the evening.

I went to the appointed place, at the designated time.

As a result of the first meeting with Brothman I had a meeting with Sam in New York City a few days after meeting Brothman. At this meeting I reported to him in complete detail all that had taken place between Brothman and myself. I gave him a written report.

Sam and I had a set and rigid procedure, one which went into complete detail regarding all meetings between us. At any one particular meeting, the details, that is the time and the exact place, were arranged. I always made a note as to the details of my meetings which we projected.

I was at the Child's restaurant at the appointed time, about 8 o'clock, some 10 days after our first meeting. I waited in the restaurant for almost two hours. At several points during this waiting period I telephoned Brothman at the Barclay 7 number, or where the Amtorg offices were, and on each occasion Brothman told me that he was just on the point of leaving. Eventually he did come, some two hours after the time which had been set.

We had dinner, and during the course of this I gave Brothman a verbal list of the types of information which the Soviet Union desired.

This list had been given to me by Sam at our last meeting. The subjects on which Russia desired specific information were the following:

[illegible]

[illegible] (continued)

I [illegible] instructions from Sam that the first matter to be considered in giving information to the Soviet Union was to clean up any unfinished business, that is, data on processes which he might have been engaged in with the woman Helen, who had preceded me.

The following were processes which were on this verbal list and in which Russia was interested:

Any process relating to the manufacture of aviation gasoline.

Any data relating to the manufacture of rubber, that is both the processes regarding the fabrication of natural rubber and any process relating to the manufacture of synthetic rubber.

Third, any information regarding the production of petroleum lubricants.

Fourth, information relating to the production of colloidal graphite. Colloidal graphite is a material used in high temperature lubrication such as in steel manufacturing processes.

Data or information relating to the production of chemicals, particularly organic chemicals such as acetone, used in the manufacture of smokeless powder, and butanol alcohol, used in many chemical processes as a basic raw material.

Finally, there was a catch-all which referred to any data, blueprints or information which might possibly be of military value. There was nothing specific as to machinery in that list.

[illegible] told me after I had enumerated these items that he could furnish lots of a goodly number of the items which I had detailed to him.

We arranged a third meeting. At this third meeting [illegible] told me that he would have information for me [illegible], blueprints and process data.

[illegible] (continued)

The third meeting took place some 10 days or two weeks after the second meeting; it was at the corner of Ivy and Church Streets, at approximately [illegible] o'clock in the evening.

As far as I can quote the significance or character of 9 in the evening or 3 in the evening is that I was actually employed at this time at the Pennsylvania Sugar.

The street was completely deserted, not a single, solitary person was visible.

Brotherman did not come down to the meeting until some 2 hours after the scheduled time of 8 P.M. In the meantime I made several calls to the office and just walked on the corner.

After I called the office Brotherman answered and said that he would be down immediately.

I told Brotherman when he arrived why he was so late to this meeting and he replied that there were a good many people there on that particular night, working late, and that it was for this reason that he felt that it would be not safe to entrust any blueprints and bring them down to me.

The total time of our conversation was some 5 minutes, during which we arranged for the fourth meeting.

The fourth meeting was to be in the vicinity of [illegible] Church Street, somewhere in that area, but [illegible] specific street. The time given was some [illegible] after the third meeting.

The fourth meeting took place; I came to New York and went to the appointed place. I was met by Brotherman, who gave me a blueprint.

I placed the blueprint in an envelope which I had with me, a plain manila envelope of the size used to contain 8-1/2 x 11" sheets. The blueprint was folded, and I gave this blueprint to Sam later that evening.

This and I had previously arranged to meet the very night that I met Brotherman.

[illegible] (continued)

I cannot recall any details of the conversation with Brothman except the fact that we arranged for another meeting.

The [illegible] took place on some 5 or 6 successive meetings, up until the middle of December of that year, 1941.

I gave the envelope containing the blueprint which had been given me by Brothman to Sam.

Before the next meeting - the subsequent meeting with Sam which took place in New York - about a week after the meeting with Brothman - the envelope containing the blueprint was returned to me by Sam.

I took the blueprint home with me.

As a result of the conversation with Sam regarding the blueprint, I told Brothman on the occasion of our subsequent meeting, that more complete data was desired than merely a single unrelated blueprint.

Exhibit
blueprint

PART 2 (B)

Up until the middle of December, 1941, I met Brothman on possibly six different occasions in New York City. The arrangements were generally of the same nature - I was to meet him at a street corner.

A pearl kettle is used for the manufacture of plastic materials. This was a resin kettle intended for the use of Cyrner Corporation of Wilmington, Delaware. Exhibit

There was no additional information; it was just a bare blueprint. This arrangement continued until December of 1941.

Sometime in December, 1941, I had a meeting with Brothman. At this time, pursuant to a conversation I had had with Sam, I told Brothman to expedite matters. I could arrange to have blueprints, or any typed material photo-copied in a short time. The reason for telling this to Brothman was that Sam complained to me that we had received nothing of any utilitarian value to us. We had only received fragments.

In addition, I told Brothman that to date the material he had given us had been entirely too fragmentary in nature and that its utility was impaired by the fact that it was incomplete.

I also told him that his method of keeping appointments was completely out of the question. By this I referred to the fact that he was rarely, if ever, on time. Brothman became extremely irritated. He stated that the Soviet Union failed to realize the value of the material he was submitting. He added that he had given much material of value in the past and he stated as such data on the Houdry Process for the manufacture of high-test gasoline, data on a high-speed turbine-type engine for use in aircraft, and also material on one of the first jeep models.

APPENDIX IV

He told me that he had given the information on the aircraft turbine-type engine to Helen's predecessor. The data on the design of the jeep models had been given to Helen. Brothman continued to say that if it was of vital information, the Soviet Union desired it; that he could furnish it on the occasion of our next meeting. He said that at this very moment in the Kendrick Offices there existed a mass of blueprints relating to the design of a military explosives plant in Tennessee.

Brothman and I made arrangements whereby on the night of the 22nd of December he was to turn over those blueprints on the military explosives plant to me. I was to get them photo-copied and return them to him that very night.

The meeting was scheduled for the Northwest corner of 51st Street and Lexington Avenue. The meeting was set for 10 p.m. After seeing Brothman I met with Sam. We made split-second arrangements to work on the night of the 22nd of December, after I had picked up the blueprints from Brothman.

I came to New York on the 22nd, exactly at 10 p.m. and walked on the northwestern corner of 51st and Lexington Avenue. Brothman never came there. I waited until the last possible moment - about twenty-five minutes. Then I took a cab to West Fourth Street - Washington Square Station of the Independent Subway. The meeting with Sam was scheduled for exactly 10:30 on the uptown express platform.

When I got to the designated platform, I thought I saw Sam on a train just pulling out in the uptown direction. I took the next express train and got off at 14th Street. Sam was there waiting for me.

I told him that I had had no success and Sam excused himself saying that he would be back in a few minutes. He went upstairs and after about ten minutes returned. Sam and I then ascended to the street level at 14th Street and Sixth Avenue, and from there took a cab to 57th Street and Ninth Avenue and went into the Ferris Wheel Bar of the Henry Hudson Hotel. We had several drinks and a long talk.

(The conversation concerned my work in Rochester, N.Y., with Al Black.)

I met Sam Brotman in the week between Christmas and New Year of 1941, in Akron. He said he had been away in Akron, Ohio, on December 22nd, and therefore could not keep our meeting. He told me that pursuant to our second conversation at the Childs Restaurant on Columbus Circle, during which conversation I had given him a list of material desired by the Soviet Union, he now had in his possession a complete report on the Buna-S process for the manufacture of synthetic rubber, and that he could turn over the complete report to me on the first of January, 1942.

(I may say right that Brotman told me of the material on Buna-S, I am sure and he was highly [illegible].)

I made arrangements to meet Brotman on that day, the first of January, 1942. I came to New York [illegible] day of 1942 in the morning about 11 o'clock and after waiting for an hour or two, Brotman came along, but he did not have any material with him. He explained that he had been working on the report, but that it was not quite complete and he said he would have it for me within a week or two.

UNCLASSIFIED

There then followed a series of meetings. Brotheman drove me in his car up the West Side Highway and dropped me off at a point where I could walk over to the Post Station.

I don't know that came day and told him of the fact that no material had been forthcoming. There then followed a series of meetings - possibly some 12 or 15 in number, about quarter of which Brotheman never showed up at all. I specifically recall three occasions when Brotheman definitely promised to have the Soble report completed for turning over to the Soviet Union.

There were the incidents: The first was a meeting at the Prince George Hotel in Manhattan. I engaged a room and on a Saturday we were supposed to work all that night to complete the report. Brotheman never showed up. The second was a meeting with Mr. Chan at LaGuardia Field on his return from Washington after having been in consultation with the Naval Reserve Commission in Washington.

I met Mr. Chan and Harry Brotheman on that occasion. We had no new material - - all blueprints, but [illegible] had no complete report.

The third such [illegible] occurred in March. Brotheman [illegible] arrangements that on a Saturday night [illegible] to New York, driving in Brotheman's [illegible] Andrew Fenster's house, where we could [illegible] the entire weekend - working on [illegible] report.

Brotheman showed up for this meeting scheduled for the northwest corner of 42nd Street and Eighth Avenue. He explained he could not go on the trip with me as his wife had come from [illegible] guests that evening.

EARLY 1942

In very late March or very early April of 1942, I was notified by my draft board in Philadelphia that I would be inducted into the Army on the 20th of April, 1942. I told Sam of this circumstance, and he told me that I should do the following:

I told Brothman that I was being transferred by my company to California in a matter of a few weeks and told him that we should therefore try to finish up the Rumba-3 report before I left the East. Brothman agreed and we made arrangements to meet on a Wednesday night early in April at the Hotel New Yorker, at eight or nine p.m.

Brothman kept this meeting. I had engaged a suite of two rooms and we worked all that night from nine o'clock up until six the following morning - Thursday morning.

Brothman had brought with him a small suitcase full of blueprints, typewritten data and calculations. In addition, he had brought along a portable typewriter. Brothman did the typing.

We worked until six a.m., annotating and pasting in the report, and assembling the material for the finished report. At six a.m. the report was complete, except for some of the few details of reconciling the material.

We went to bed and at ten a.m. Brothman said that we'd have to go downtown to our [illegible] offices to work [illegible]. This he did. After Brothman left, I went out and had something to eat along 34th Street. I recall the day very well since there was a heavy downpour.

Except for the time when I went out to eat, I stayed in the hotel room. I had made arrangements in Philadelphia whereby I could have the day off. I made those arrangements several days before I came to New York.

Brothman returned that evening about six p.m. We completed the brief job of assembling the material and Brothman left.

The material for the Duna-3 report consisted as follows:

There were at least 200 typewritten, single spaced sheets on onion skin paper. These were a copy, not an original. The only original typing was that had been performed by Brothman that night. These were merely notes. In addition, there were a large number of blueprints, some 25 or 50 in number covering not only the details of the process but the design of specific items.

All of this I assembled into a single package, wrapped it in plain brown paper and took it with me when I checked out of the Hotel New Yorker. The material in the typewritten pages concerned a complete description of the process - the materials used in the manufacture of synthetic rubber, temperature, time of contact, and so forth and a great deal of theoretical and practical data relating to the various phases of Duna-3.

The whole report was a complete exposé of the method by which Duna-3 is made.

I checked out of the Hotel New Yorker shortly before seven p.m. and went to the area of 23rd Street and Sixth and Seventh Avenues. I waited in the doorway of Horn & Hardart Restaurant for a few minutes. Then Sam came along and I turned over the material on Duna-3 to him - the complete report.

Attached

[illegible] (continued)

[illegible] at various intervals in the course of [illegible] 15 minutes with Brothman, from the first meeting, until early in April, he turned over to me various [illegible] relating to the [illegible] espionage. These I kept in my home in Philadelphia and never turned them over to Sam.

There was also a considerable amount of written material, including a description of the process, and a good deal of theoretical data. The material was in Brothman's handwriting.

Offer i
evidenc

There notes were made on the night that Brothman and I were together and evidently it was more convenient at that time for me to do the writing. He read them off; I can write very rapidly, and later on they were typed up. They referred to specific pieces of equipment.

Exhibit
witness
of Sir
in Apri

Pending my selective service classification, I went to the Army and was turned down by the Selective Service Board because of my appendectomy and was classed in Class 4F.

I first communicated with Sam and advised him of the fact that I was again available for espionage work.

Thereafter, on instructions from Sam, I reestablished contact with Brothman and again on orders from Sam, advised him that I would not be transferred from California but would remain in the Fort.

The next meeting with Brothman took place in New York but did not occur until some time in late [illegible], 1942.

There were several occasions in between which Brothman did not know. I had met Yakovlev in Brownsville, Texas in January or February.

HARRY GOLD (continued)

I got in touch with Naomi Brothman at Brothman's home on one occasion and she advised me that Abe was at his other office.

She gave me the 'phone number and I got in touch with Abe there.

There was one meeting which occurred with Brothman in the area of the Hendricks offices on Church Street.

At this time Brothman advised me that he was having difficulties with the management of the Hendricks concern. This conversation took place in late May of 1942. He told me about difficulties at Hendricks.

There followed another period in which I was unable to get in touch with Brothman for several weeks. Finally I did call him at the office number which had been furnished me by Naomi Brothman.

I was in New York and I met Brothman in the Grand Central Station, near the Graybar Building. We went to a small drug store off one of the side passages of the Grand Central Station and there Brothman told me that he was no longer employed by the Hendricks Company. He stated that he and his co-worker, Artie Weber, whom he called Henry Golwynne, had formed a company known as the Chemurgy Design Corporation. He stated that from that time on I could get in touch with him at the other offices in the Graybar Building. This was in June when he advised me

Further conversation at or about this meeting concerned the Duna S report. I told Brothman that my Soviet superior had received instructions from the Soviet Union, in which a highly favorable opinion was given on the Duna S material.

There was one particular piece of machinery involved in the Duna S process which the Soviet Union desired further information on. This was designated by its blueprint drawing equipment, and apparently the Hendricks Company had it and he could not

obtain this information. He did say that in place of the data on this one particular piece of mixing equipment he could furnish an entire report on the whole chemical engineering unit operation of mixing and that he could have this ready in a very short time.

I also told Brothman that my Soviet superior desired very much that he return to the Hendricks Company as an employee but Brothman stated that this was impossible since he had already left the Hendricks firm.

HARRY GOLD

In the latter part of June, 1942, I came to New York and met Brothman somewhere in the Grand Central area.

We took a long walk up and down Sixth Ave., in the course of which I detailed to him the fact that my Soviet superior desired very much that he continue to work with the Hendrick Co.

Brothman told me that it would be impossible for him to leave Chemurgy entirely and go back to Hendrick, but that he believed he could work out some sort of consulting arrangement with the Hendrick firm, whereby he would still have access to their office and to their files.

The instructions from my Soviet superior, Sam, which I gave in detail to Abe, were to the effect that the Soviet Union was still very much interested in any information whatever on the synthetic rubber Buna-S, and they were very anxious to know of any developments that might come along in that field.

The over-all idea, however, behind the instructions of Sam was that by working for a firm so vitally involved in the chemical engineering process field as the Hendrick Co., Brothman would be in a strategic position where he could lay hands upon data the Soviet Union desired.

Sometime in the summer of 1942 I had a conversation with Abe Brothman, in which he told me that he was very actively engaged in designing a nickel catalyst plant for the Rufert Chemical Co. of Seymour, Indiana. Brothman stressed to me the fact that not only was this catalyst be put to the conventional use in hydrogenating shortening materials from vegetable oils, such as Spry and Crisco, but also that it would be a very fine catalyst, and could be used for the production of aviation gasoline, and also as a general catalyst in organic synthesis for the production of various [illegible].

HARRY GOLD (continued)

Brothman stated that the catalyst plant being prepared for the Rufert Co. was of an entirely new type, since the nickel catalyst was carried already prepared in the material which it was to hydrogenate.

During the course of the conversation, Brothman told me that he was having great difficulty in designing the plant for the Rufert Co. since the chief chemist at Rufert, a man by the name of Freed, had refused to carry out much of the vital laboratory work, that is, the laboratory work by means of which the basic data for the design could be made available.

In the very late fall of 1942 Brothman turned over to me the complete report on mixing. This was on a week-day evening in the general area of the Grand Central Station. The material which I received from Brothman was entirely in a black leather ring-type notebook, but the rings were large, some two or three inches in diameter, and the material consisted of the following items:

First, some 300 typewritten pages, onion-skin paper - these were a copy, not an original; secondly, some 50 to 100 nomographs; thirdly, a vast amount of printed technical literature, all, as far as I could see, bearing the imprint of the Hendrick Co.

The printed technical literature gave data relating to the design and the choice of particular types of mixing equipment for doing certain chemical jobs.

I took this material and went into a small stationery store on the south side of 42nd St. just off Lexington Ave., going in the direction of Third Ave. There I purchased some heavy brown wrapping paper and some twine and wrapped the entire report securely. The package was roughly 5 inches high by 15 by 20. It was a very bulky package.

HARRY GOLD (continued)

Later that evening I went to the Ferris Wheel Bar on 57th St. and 9th Ave. and there, by pre-arrangement, met my Soviet superior, Sam. I turned the material over to Sam.

I had a conversation with Sam that evening. As a result of this conversation with Sam I told Brothman that a very important Soviet dignitary was coming to this country in a very short while, before the end of 1942. This man was coming here for the express purpose of meeting with and speaking to Brothman, though there were other ostensible and legitimate reasons for his visit. The primary purpose, however, was to meet Brothman.

Subsequent to that a meeting occurred between Brothman, Sam and myself at the Hotel Lincoln, 45th St. and 8th Ave., New York. The arrangements for meeting with Abe had been agreed upon, that is, the day and the place had been set at a previous meeting. Once this had been arranged with Brothman I notified Sam of the day, the time and the place.

Brothman met me in the lobby of the Hotel Lincoln and we went upstairs to a two-room suite which I had engaged. The time was roughly 8:00 P.M. About twenty minutes later there came a knock on the door, and I opened it to admit Sam. According to previous arrangement I had made with Sam, I introduced Sam to Brothman as George.

The meeting lasted until about 2:00 A.M. The following items were discussed during our meeting: Sam gave a good deal of praise to Brothman for the Buna-S report. He said that this work alone was equal to the value of two or three brigades of Russians. Then followed a discussion on [illegible] between Sam and Brothman.

Brothman showed Sam certain of the items [illegible] of equipment, that is, of the Buna-S [illegible]. In particular I recall one which was a [illegible] drums of the spent nickel catalyst, [illegible] wise.

At this time Sam managed to insert the thin edge of the wedge as regarding the suggesion that the Soviet Union would appreciate it very much were he able to obtain work with a large industrial firm, preferably in the synthetic rubber or the petroleum field, say one such as Goodyear, U.S.Rubber, or Sun Oil.

The final item that was taken up was the matter that Sam told Brothman that in the future, to expedite the completion of his reports to the Soviet Union, that he would furnish stenographic help. In that way Brothman, a stenographer, and I could work together and more rapidly finish material for the Soviet Union.

At the conclusion of the meeting Sam left. As a matter of fact, three of us went downstairs. Sam left after a very brief goodbye, and while Brothman was standing there, Brothman told me that I had made him the happiest of men, and that I had provided one of the most satisfying experiences of his life by causing him to meet "George". Brothman left me saying that he felt so elated he was returning to the Chemurgy offices to work.

FRANK GOLD (cont'd)

slept in the hotel that night and I checked out about six in the morning and went to Philadelphia to work.

Beginning about February of 1945 there began a series of meetings between Brothman and a girl called Jennie Zawrucka and myself. The purpose of these meetings was to complete a report on the so-called aerosol bomb. The aerosol bomb is, among other things, a means of dispensing insecticides in a very fine dispersion or fog.

Beginning in January, Brothman started to press me for stenographic help, and I in turn questioned him about living up to his promise. Sam, however, said he could not be bothered and simply refused to do anything about keeping his word. In order not to offend Brothman I got in touch with the man who had originally introduced me to espionage work in 1935 and through him was introduced to a young girl called Jennie Zawrucka.

We continued from February, 1945, with Jean, up until about June of that year. I would say some ten meetings occurred between Brothman and Zawrucka. They all took place in the Amtorg offices in the Empire Building, and the usual procedure was for Brothman to dictate to Zawrucka. She would take shorthand notes, take them home, do the typing and she would sometimes send it to me by mail; most of the time, however, I picked the material up when I met her next. There was no typing done there. Some arrangement was effected for getting her a typewriter, she did not have one I know, but I am not clear as to what the arrangement was.

Jennie Zawrucka knew me as Harry Gold. She addressed me usually as Mr. Gold.

Brothman knew me as Frank Kessler but just before Jennie Zawrucka came to work with us, I told Brothman that the girl knew me as Harry Gold, and that this was the name, that he should express no surprise. I also told him that he could use this name in the future as a telegram drop.

HENRY GOLD (cont'd)

I stopped using Jean in June or July of 1943.

The meetings during which Brotman, Jean and I worked on the aerosol bomb report were always held on week-day evenings at the Chemurgy offices. I would meet Jean at first in the Pennsylvania Station, Newark, and would escort her to New York and then to the Chemurgy offices. Later I came directly to New York and met her in one of the Pennsylvania waiting rooms there.

After her services were terminated, I would usually come to New York, call Brotman and see him either somewhere in the Grand Central area, or if no one else were in the Chemurgy offices I would go up there and speak with him.

Jean was compensated by being paid in cash by me. It was either $10 or $15 per week. I was never repaid these funds because Sam had no idea that I was taking such action; in fact one of the reasons for discontinuing the work is that I ran out of money.

Another general practice, with the termination of the services of Jennie Zawacka, was for me to come to New York on Sunday mornings and work in the Chemurgy offices with Brotman. The subject on which we were working and which Brotman had told me to offer to the Soviet Union concerned the production of magnesium powder for use in tracer bullets and flares. The methods on which Brotman was conducting the design work was a novel one in that it involved spraying molten magnesium through a nozzle into a chamber containing inert gas, helium. The fine mist of magnesium particles would form, solidify and fall to the floor of the spray chamber and could then be removed. This method is opposed to the conventional one whereby an ingot of magnesium is taken and subjected to a succession of grinding or attrition processes until the desired particle size was produced.

One of the principal advantages of the process on which Brotman was working, and of which he told me the original idea had been Henry Colwyne's, was the virtue that any danger of producing a fire by grinding the magnesium was completely avoided. Also a more uniform particle size could be obtained.

[redacted] (cont'd)

As a result of beginning this work with Brothman, I spoke to Sam about this process, but I did not report to Brothman the true gist of what Sam had said, namely, that the Soviets already had processes for producing magnesium powder.

In the summer of 1943 Brothman obtained for me a job with a firm in Paterson, New Jersey, called S & G Interstate Corporation. The purpose of the survey I conducted at this plant was to determine whether the material could be used in a commercial distillery. I worked there under the name of Harry Gold and was paid some $300. The man with whom I worked at the Pennsylvania Sugar Company, in the Distillery Division, helped me to prepare the report. The reason for using the name Gold was because he helped me prepare the report and knew me only as Harry Gold.

Beginning in 1944 I maintained only sporadic contacts with Brothman, through 1944 and 1945.

Early in 1944 I came to New York, met Brothman, and he told me that he was doing work in the further development of aerosol insecticide bomb for a firm called the Regal Chemical Company of Brooklyn. He told me the firm was under a Government contract. He told me that on returning from a trip to Washington, Mr. Heilig had promised him a fee, or royalty of a fraction of a cent for each bomb produced, and since it was contemplated to produce several million of these, the total sum would have been very large. He at that time Brothman took me to what he referred to as his laboratory which was at 114 East [redacted] Street, New York City. There I met a Negro chemist by the name of Gibbs, who was working in a very rudimentary sort of laboratory.

In September 1944 I met Brothman in a bar on 32nd Street, the south east corner --a combination restaurant and bar -- and we had a long conversation during the course of which Brothman told me that he had had a quarrel with Harry Golwyne, with his former co-worker, Weber, and with Mr. Heilig of the Regal Company. The upshot of all this had been that Brothman had been thrown out of his Chemurgy partnership with Golwyne and Weber, and had been dismissed from doing any further work or obtaining any further fees from Heilig. Brothman told me

and [illegible] with this [illegible] people --
[illegible], [illegible] collar, [illegible] and
[illegible] and [illegible] a chemical
[illegible] socialism. At this time
[illegible] socialists. [illegible] and a very coy
[illegible] and I could see [illegible] clear, he
would [illegible] have to work with him.
[illegible] September, 1944. [illegible] came
[illegible] kept but I continued to [illegible]
[illegible], Pennsylvania [illegible] company.

I continued to [illegible] Trotskyman, but only
[illegible]. [illegible] [illegible] until
[illegible], 1946.

[illegible] meeting with [illegible] occurred in February,
1946.

[I was turned over to another Soviet superior
[illegible] known only as John.]

[illegible] of [illegible] my relations with [illegible]
[illegible]. I was turned over to a man whom
[illegible] as John. I worked steadily with John
[illegible] February of 1946.

[illegible] only the incidents involving [illegible] and
[illegible] the first occasion, some time during
[illegible] man [illegible] would it be possible to
[illegible] contact during [illegible] my newly formed
[illegible] [illegible] accurately. I only [illegible]
[illegible] to John and he said
[illegible] no point in [illegible] the very
[illegible] Soviet [illegible] through with

[illegible] traffic [illegible] involving [illegible],
[illegible] [illegible] .ot.]

[illegible] my [illegible] to the [illegible]
[illegible] February, 1946, [illegible] arrest of
[illegible] work and not [illegible] this
[illegible] [illegible] [illegible] the course of the
[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] difficulty with my [illegible], I [illegible]
[illegible]. Brodkin immediately countered
[illegible] could I not [illegible] or other call [illegible]
[illegible] rejections, and offer of a job from

Exhibit #1 (cont'd.)

...e, in late May, 1946 I joined the firm of ...Associates, as Color Chemist, at a salary of $100 a week. I am still working in the laboratory in May, 1947.

...ursday, May 23, 1947. I reached a point with my work in the laboratory where I could work time ... to do what consulting, technical literature. ... this was at 5:00 o'clock in the afternoon and I left the laboratory ... to the ... library. On my way to the ... I left the ... at Queens ... stopped off at the ... offices to ... whether there was any further material ... at the office for me to look up.

Then I entered the Brothman offices (at about 3 PM), Abe came forward, grasped me by the arm, and broke into my narrative of how the laboratory work was progressing.

He said, Look, Harry, the F.B.I. was just here. They know everything. They know all about us. They know that you are a courier -- must have been that "Bitch, Helen". He said "They even have pictures of you and me together; you've got to cover me up. They are coming to see you this afternoon, and you've got to tell the same story I did. Listen did you know John?" I replied, No. He said, "Well, you've got to say you did to cover me up". He then launched into a description of a picture he said had been shown to him by agents of the F.B.I. He said this was a picture of a man with a small, wizened face, a wry grin, a receding hair line, and curly hair.

Brothman also told me that I had to tell the story -- my story to cover up the true facts of how Brothman and I had actually met. He made the suggestion that possibly I should tell the F.B.I. that we had been writing a technical book together. He also added that Miriam Moskowitz was at that moment on her way over to see an attorney at the Amtorg Company, one Gibby Macklemen.

Identify Moskowitz
Describe Gibby Macklemen

Affidavit (Continued)

Miss Moskowitz had originally come to the Brotherman firm as a Secretary and some time thereafter had been promoted to a full partnership in the organization.

I believe that the partnership arrangement was arrived at some time in 1946, Miss Moskowitz came to the firm some time in 1945.

In 1947, Miriam Moskowitz was the Secretary of the firm and also served as the bookkeeper, stenographer and office manager.

The only supervision that I can recall is that of Herbert Brotherman.

Miss Moskowitz was a full partner in the firm with Brotherman and Oscar Lange.

Brotherman then urged me to return to the Isburst Laboratories as rapidly as possible and this I did.

Brotherman told me that I had promised agents of the F.B.I. that he would hold no conversation with me whatever, prior to the time that they interviewed me, but he wanted me now to reveal that there had been a theft between us.

Brothman told me that John had been identified to him by Agent Chapman on apprehension as one John Colins. He pronounced it as if it had been Italian, German or Irish and asked me should I be shown the photograph, that I should identify John as such.

Brothman added that I should invent any story whatever to cover the true facts as to how we had actually met. He suggested that possibly it would be a good idea to say that we had been working on and writing a technical book together.

[I returned to the firm's laboratories in Elkhurst and on the way concocted the false story involving Carter Goodlass.]

On the way out to the laboratory, I considered several stories which I could tell to conceal the true facts as to how I originally met Abe. I rejected several and finally selected one.

About 20 minutes after I arrived at the laboratory, that was about 4 P.M., shortly after I arrived at the laboratory and after 4 P.M., 2 men entered and asked for Harry Gold. I said that I was Harry Gold. They told me that they represented the United States Government and wished to speak to me.

I wanted to bring in that I saw Miriam Moskowitz

H. D. Hill (Continued)

Sherman was so big that he did her. At that time I noticed that Miriam Schoudts had come in just after Sherman. I excused myself and she spoke to me for a minute. She said that Abe had gone home with a splitting headache and that she and Abe would be in touch later that evening. She left.

I am certain that they answer. It is just that these facts impress themselves on me, and that they would get in touch with me later, Brotman and Schoudts.

After Miriam left, the 2 men identified themselves to me as agents Sherman and O'Brien of the F.B.I. They advised that they had been to see us earlier that [illegible] and that he had mentioned my name to them. [illegible] that to sit in there and talk and this [illegible] for a while until the employees of the [illegible] all gone home.

[illegible] sitting in the car, the men [illegible] showed me several pictures and [illegible] these people. I was shown one [illegible] likeness, wide rim glasses receding [illegible] hair. At the matinee.

[illegible] man as John Golish, alias [illegible] Abe had earlier given

[illegible]

[illegible] being the result of [illegible] hours of interrogation [illegible] every [illegible] I [illegible] on the [illegible] [illegible] by the [illegible] [illegible] full level of [illegible] noodles. The [illegible] of [illegible] noodles [illegible] [illegible] completely [illegible] [illegible] [illegible] [illegible] noodles.

I [illegible] the [illegible] [illegible] [illegible] by Agent Shannon [illegible] [illegible] [illegible] the [illegible] [illegible] story I told them.

The agents left about 9:30, but before they did, [illegible] call from Marlingdale I told her I was [illegible].

Shortly after the agents left, Marian called, and I told her I was through in the laboratory again.

A little while after that Marian and Abe drove up to the laboratory to get her. They entered the laboratory, and Abe jokingly said "Well, how did you make out with Gloria?" I started to say that I thought I had managed to get away with it, but Marian interrupted and gave me a big hug. She told me that I had been wonderful and incredibly nonchalant when the agents had entered.

We drove on to a restaurant on Queens Boulevard, called Army or Children's. During the course of our dinner there, only two subjects were discussed: first, the fact that I spend a considerable time reassuring each other that practically all of the F.B.I. didn't look as much as we had at first feared.

Then Marian told me that on her way over to see Libby she thought that she was not being trailed for a while, but had finally succeeded in shaking off the people.

Later on there in the restaurant Marian stated Libby's opinion had been for nothing that she [illegible] to talk to the F.B.I. [illegible] just to tell them we were busy and that we had to [illegible].

After we finished dinner at the Chinese restaurant, at about 10:30 or 11 PM, Abe, Marian and I returned to the [illegible] in Elkins Park. There we held a long conversation, during which the following matters were discussed: First, Abe wanted to know what story I had told to agent Sisenda and Geisler, and I replied in detail the completely false fable involving Carter Goodrich, the Quarles Harris Society, the Franklin Institute in Philadelphia, and the dinner at Lou Tendler's.

Abe then approved of this. It then began to question me as to whether there was anything in my past involving either my employment activities or personal life which might embarrass me if I were subjected to [illegible] questioning.

[illegible] that I could not tell him anything about [illegible] I had done for the Brick Union, but I did [illegible] the facts of which he was not aware. These [illegible], first, the fact that I was in naturality [illegible] and did not have a wife and two children [illegible]. The second point was that my brother [illegible] killed in action in the U.S. Marine, as I had [illegible] back in 1943; but he was still alive.

[illegible] point that came to mind was the discrepancy [illegible] by both Brotman and I that a discrepancy [illegible] between the dates 1940 and 1941. Brotman [illegible] he had told the agents that I had come to [illegible] in the fall of 1940. I had given the true [illegible] 1941. I was disturbed at this, but Brotman [illegible] to by saying that I could always tell [illegible] since I had made an error, that my memory [illegible]. He made the mistake, and he insisted that [illegible] to his book which established the date as 1940.

[illegible] Brotman about the pressure he had felt re[illegible] there [illegible] by Frank Shannon and Agent O'Brien, where [illegible] and I were seated in a restaurant with our [illegible] close together. He said that he had been threatened, but he could not identify the source [illegible] too badly shaken.

I was saddened [illegible] that I had been indicted [illegible] 1941 and various members of the [illegible] investigation during the following year, [illegible] 1945, as well [illegible].

[illegible] and I discussed the fact that the use of the [illegible] could possibly be explained away [illegible] by the allegation that I had used this name to cover up [illegible] I had used this name to cover up the Pennsylvania Sugar Co. [illegible] I had also [illegible] truck. She appeared [illegible] and [illegible] excellent idea.

[illegible] then excused herself from all of this conversation. At this point, however, she left -- about 1 AM -- to go out [illegible] and graft, and while she was gone Abe [illegible] to whether I believed my statements towards [illegible] of the first time he had diverted Shannon [illegible] in my direction. He said that it felt like [illegible] would have run across [illegible] or later in my [illegible] that he was sincere. He was trying to appear to [illegible], but his motion at directing me was the wro[illegible]

Before leaving the laboratory, the vital matter which was discussed was Brothman's suggestion that should I be questioned further, that I tell a story about our having worked on the preparation of a technical book.

Either that night or the following evening, Abe, Miriam and I drove from Queens to the Penn Station. I was returning home to Philadelphia for the Memorial Day week-end.

During our drive, a quarrel broke out between the two men involving Tom Black. Abe was very critical of the fact that on several occasions in 1945, 1946 and 1947 I brought Black to the Brothman Laboratories to assist with the work there and also to the engineering offices to act as a consultant. He was also critical about getting Black a job in Philadelphia.

Actually, Black was the man who originally introduced me to my first espionage agent, one Paul Smith.

Black had last been to the Brothman offices in April of 1947 in connection with consulting on the possibility of Brothman designing a plant for the production of [illegible] for the Antone Company. At this time

I had come close to the fact that Black had covered the enjoyment of his date during the course of conversation upon this subject of Penicillin for the United Nation. We even discussed the inconsistency involved in obtaining data by espionage and then trying to put a mind build.

The principal point of the entire matter seemed to be that by my having had such a disastrous run on Black around the Brotherhood Labor Union and office, I would thus focus the attention of the FBI upon Brotherhood and in turn reveal their espionage activities. I in turn got very angry because Black had done all of this work for me for whatever and in fact had never been compensated in having him train fare paid. We had just come to the point where I was ready to hit the when Black broke up the quarrel and said that we were exceedingly foolish to fight at such a vital time. It was that for a fight to break out between the and Black exactly what the FBI desired. In that way they could manage to disclose the falseness of our stories.

I parted in the front of the car. It was the's car. It was a 4-door Pontiac Sedan. The mag

...wing, I noted elements of him in front, and ...ar and noted in the back.

...and at road ... about the time we were ... the Queensborough line. Then we ... the station if was in full swing and ... in trade blows.

... from Philadelphia in a day or two and went ... to Frothman's home in Sunnyside. I returned ... Mrs. Mc, his wife heard and I drove over ... Frothman's apartment which is on one of the ... just off Central Park ...ent.

... the apartment house, but first warned ... with carefully the windows across the ... that we were being observed.

... , Mr. ... re were in conway with ...

... Frothman's, he told me that he ... further advice as to how we ... should there be any further

All of this conversation took place in the presence of Naomi Brothman. Brothman was in the apartment about 30 minutes. I would judge this was about 9 P.M. When she came down, Jimmy Needleman was with him. I had met Needleman before. I had first met Jimmy Needleman in the early June, 1946, after I started to work for the Brothman organization.

Save for redir: description of Needleman and Ambers arrival and conver

Needleman was in a suit. He was not wearing a hat.

Needleman and the rest ate the cake. Needleman was seated with me in the back; Naomi Brothman was in front with Abe. We drove for about forty minutes.

Naomi, Abe, Naomi and I left Sunnyside that evening, our ultimate destination was Abe's summer home at Lakehill, N.Y.

The weather was drive, but drove for about five hours, eventually dropping Jimmy off at a

[illegible] occur in [illegible].

[illegible] the course of the ride, Jimmy said the following: If the one I should run be interrupted by the FBI, to tell them as follows: [illegible] with them; tell them to go to hell; [illegible] out of the office; tell them you are busy, you don't have time for such nonsense. [illegible] possibly more, but I don't recall.

After that, Abe, Jimmy and I drove to Abe's summer home near Peekskill. I don't recall what we spoke about on the trip on.

When we arrived, the two I went for a walk along [illegible] roads near his home, and during the course of this walk, the following matters were discussed: First Abe wanted to know whether Welch had given the FBI any information about the fact that I had turned over blueprints on the high speed [illegible] engine; and also blueprints [illegible] the very first type models.

[illegible] mentioned Welch to me during our very [illegible] in September of 1941 or the Soviet [illegible].

Memorandum

It was said that the material on the aircraft engine had been given to John and that on the jeep had been given to Helen. He then returned the home that possibly Helen had failed to appreciate the nature of the drawings she had received since she has no technical background. The second matter was that I told Brotherman of a visit by two agents of the FBI to my home in Philadelphia that weekend. This had occurred shortly after I had gotten to Philadelphia. I told the that the agents spoke to me and inquired whether I had indicated to Shannon and O'Brien that there still might be some of the blueprints which she had turned over to me belonging to the Hardrick Company. She was very much upset by this and criticized me for ever having indicated to Shannon and O'Brien that such blueprints might still be in existence, but I assured him that none of such had turned up, but that the agents had just conducted an investigation, but had merely made an inquiry.

...

[illegible]

of his petitioner's Mr.

He told me further that I should not answer
[illegible] and should show no fear,
[illegible] necessary, I should be defiant.

He told me that very likely the Grand Jur[illegible]
[illegible] which we had first
[illegible] and discussed this matter at
[illegible]. I then told him that I was afraid that
[illegible] recorded in stenographic records on some of
[illegible], particularly that I had
[illegible] the southwest.

I did not [illegible] her.
(Telephone conversation)

He told me that [illegible] very far fetched
[illegible] that I should not worry at all.

I felt it was very far fetched but
[illegible] next and ordered, such a post
[illegible] years, and on

[illegible] that I should stay clear of the matter of giving
[illegible] rise.

I told Abe in response to his question, that I had succeeded in creating the impression of a small, timid, frightened man, who had become involved and had committed an overt act and was now harrangued by the ramifications of this affair.

Abe and Miriam both said that this was wonderful.

This completes the Tokarski business.

I remained with Abe Brothman and his associates until June of 1948. In the months between 1947 and June of 1948, on several occasions Brothman stressed to me that despite the fact that the firm was no longer paying regular salaries, that I could not leave the organization because two of us had to be together in close proximity, so that we could check our story, should there be a Federal investigation by the authori-

[illegible] May of 1948, Abe and Miriam went on a [illegible] Adirondacks together. They were gone [illegible] ten days. They returned very early in June. Following their return, Vago, Levine and I left the Brothman organization.

On the last time that I saw Abe which was on a Saturday, very early in June, 1948, he told me the following words: "Don't pull a Louie Budenz".

Brothman told me that should I be questioned by the Rover boys. I understood he was referring to the agents of the F.B.I. He told me that I should remember to adhere to the false story we had originally given to both them and the Federal Grand Jury. The point is that he said the words in a threatening tone.

FD-141
(7-1-48)

BULKY EXHIBIT

Date received 11-14-50

ABRAHAM ROTHMAN

100-95068-18
(Title of case)

Submitted by Special Agent JOHN E. COLLINS

Source from which obtained P. RAUSCHENBACH, PERSONNEL DIR.

Address AMERICAN CYANAMIDE CO'N. 30 Rockefeller Pl.

Purpose for which acquired EVIDENCE

Location of bulky exhibit IN CABINET WITH FILE

Estimated date of disposition TO BE DECIDED AT CONCLUSION OF CASE

Ultimate disposition to be made of exhibit RETAIN

List of contents:

✓ 103. Photostatic copy of the employment application and related Papers of Alfred William Osborn

Destroyed 2/13/52 Collins

100-95068-18
60
F. B. I.
JAN 1 1951
N. Y. C.
ROUTED TO FILED

FD-141
(7-1-48)

BULKY EXHIBIT

Date received 12-13-50

ABRAHAM BROTHMAN

100-95068-1B
(Title of case)

Submitted by Special Agent JOHN M. COLLINS

Source from which obtained MISS JOHN M. FOLEY

Address SDNY

Purpose for which acquired INVESTIGATION

Location of bulky exhibit IN ENVELOPE WITH FILE

Estimated date of disposition TO BE DECIDED AT CONCLUSION OF CASE

Ultimate disposition to be made of exhibit RETAIN

List of contents:

104. Photostatic copy of affidavit of USA Irving H. Seppol.
105. Photostatic copy of Judge Irving R. Kaufman's charge to jury.
106. Photostatic copy of Judge Kaufman on certain motions made by defense counsel William M. Kleinman.

* All of the above were submitted to US Circuit Court of Appeals by the government in opposition to defendants application for release on bail pending appeal.

Destroyed 2/12/52
by SA John M. Collins

(61)

100-95268-1B
F.B.I.
JAN 1 1951
N. Y. C.
RECORDED | INDEXED

FD-141
(7-1-48)

BULKY EXHIBIT

Date received [illegible]

[illegible]

[illegible]
(Title of case)

Submitted by Special Agent J. M. Collins

Source from which obtained AUSA Vincent P. Rao

Address

Purpose for which acquired [illegible]

Location of bulky exhibit [illegible]

Estimated date of disposition [illegible]

Ultimate disposition to be made of exhibit Retain

List of contents:

✓ 107. [illegible] ABRAHAM and NAOMI [illegible]

Destroyed 2/12/52
by SA. John M. Collins

100-95068 - 18 (62)

JAN 23 1951

FD-141
(7-1-48)

BULKY EXHIBIT

Date received 5/1/51

ABRAHAM [illegible]

100-95068-1B
(Title of case)

Submitted by Special Agent John F. Collins

Source from which obtained SAC, John[illegible]

Address

Purpose for which acquired Investigation

Location of bulky exhibit In cabinet with file

Estimated date of disposition To be decided at conclusion of case

Ultimate disposition to be made of exhibit Retained

List of contents:

108. Photostatic copy of letter dated 3/11/51 from John C Vinton addressed to Irving M. Saypol.

Destroyed 2/13/52-
JFC

63
100-95068-1B
[illegible] NEW YORK
MAY [illegible] 1951

FD-141
(7-1-48)

BULKY EXHIBIT

Date received 5/5/51

[redacted]

100-95068-1B

(Title of case)

Submitted by Special Agent [redacted]

Source from which obtained John L. Foley

Address [redacted], Ky

Purpose for which acquired Investigation

Location of bulky exhibit In cabinet with file

Estimated date of disposition To be decided at conclusion of case

Ultimate disposition to be made of exhibit Returned

List of contents:

109. Photostatic copy of appeal filed on behalf of [redacted]

Destroyed
9/25/57

64
100-95068-1B
[redacted]

FD-141
(7-1-48)

BULKY EXHIBIT

Date received 5/8/51

ABRAHAM BROWN, was

100-95068-1B

(Title of case)

Submitted by Special Agent JOHN F. COLLINS

Source from which obtained Warden E.G. Thompson

Address Federal Detention Headquarters, NYC

Purpose for which acquired Investigation

Location of bulky exhibit In cabinet with file

Estimated date of disposition To be decided at conclusion of case

Ultimate disposition to be made of exhibit Retained

List of contents:

110. Photostatic copy of letter from Jacob [illegible] to [illegible] Markowitz dated 4/20/51.

65

100-95068-1B

[illegible] NEW YORK

[illegible]

Dear Nat,

This note is being sent you because of the urgent need for action in behalf of Brotman & Miriam Moskowitz. No matter how busy you are, you must immediately take care of the various matters to be discussed in this note. Couples liberty, their sole resources, & the peace of mind & happiness of their families are involved. Because of this, if you cannot come on Saturday, come during the week. Your coming to the attention of Mr. K. will hurt me very little if any. Mr. K. may already know of your having come personally. He already knows of Mr. Minton. Here are the various matters:

1. M. Moskowitz - You've been asked to prepare her appeal. You must get started on this immediately. In addition, most important, she was digested this past Wednesday to file an "election not to serve form", otherwise they would have shipped her out of the city. Henceforth while this form is in existence her time has ceased to count. It is my belief that this was done for the following reasons (a) No visits from an appeal lawyer (b) It is a city jail & not a Federal one - & why should the Warden there take responsibility for a Federal prisoner especially when (c) She is ill, bad stomach & getting loose (d) A little troublesome - complaints about food, commissary & perhaps more. Therefore it is necessary to try to get the authorities (Warden & then Mr. Bennett, Director of Prisons in W'ton.)

for Abraham to stay until determination of her appeal, as is ordinarily the practice with the writ. If after a fair effort, this is unsuccessful then all matters must be straightened out (Tested Chemicals, etc.) so that she can allow Israel to be shipped out + thus not lose any more time than is necessary. She is eligible for parole on July 28th (5 years in) plus the number of days for "Selection" not to serve remains in effect. Ordinarily she has excellent chance for parole either. In view of the color in this case the chances are stated slightly. However, more facts + color should be gathered to prove that she is innocent + not a "Commie". so as to aid her chance for parole. For this + purpose of her appeal, + you should consult with MR. MINTON. I don't think you have time to argue this appeal this spring. Therefore you should get an extension of time until the fall + see what happens with her parole. The parole board will be here in June, + their decision comes 3 weeks later. Naturally if she gets parole, there would be no necessity in appealing in the fall.

2. MRS. Rothman has been understandably emotionally upset because of the ordeal for almost a year. On top of this she has financial difficulties. I'll give her a call when he comes to see you + get time + patience. I encourage her to see you or call you anytime she has problems

To N A. MARKOV - 2

2 (cont) Wednesday Mrs Brotherman ~~was~~ had ~~to~~ her weekly visit on Monday. When she learned on Wednesday about M. Mosconey's possible means of skipping her husband, she tried to see him on Wednesday but was turned away. Likewise on Thursday & Friday. In desperation she asked Messing to come to see Brotherman on SATURDAY & convey the message.

3. You must arrange promptly to see MR. MINTON & let him know that in connection matters you represent Brotherman. Also discuss M Mosconey case with him. If he isn't there speak to MR. McNULTY, his partner. Tell MINTON (or McNULTY) that Brotherman sent you & that he understands that Minton may not want to argue the appeal until the fall. Anything that MINTON wants to do is perfectly O.K. However if appeal is going to wait, to please make strong appeal for bail. Carrying this out, will indicate to MINTON that your present Brotherman ~~or~~ displace Messing. Ask MINTON about printing of minutes & follow same up with Messing. Messing was given months ago $3,000 specifically for the printing. (ask cost of same). ~~—~~ Messing when he was in S.H.T (yesterday) said that Minton was going to argue appeal in June (which means he has to file appeal within the next four days), & also that the minutes & briefs were already printed. Follow up on all this immediately.

P 4 - 7/25/51
NAM

4. Tested Chemicals Inc. — This matter has been terribly neglected & therefore requires prompt attention. The plant has been closed now for several months. Get together promptly with Mrs. Brotman & Clara Moskowitz (Mrs. Mo's sister) for full details. It appears that all the stockholders, except for Brotman & Moskowitz, want to make an assignment for benefit of creditors & want to appoint Messrs as assignee. THIS MUST NOT TAKE PLACE for many reasons — such as ~~this~~ (1) His questionable honesty & morals (2) His lack of competence (3) He has no need to waste the firm's funds that he owes & (4) his interests conflict with those of the other stockholders (such as — While the plant was being built Brotman & M.M. worked a practically continuously for 6 weeks — all of Sept. & ½ of October 1950 rendering engineering service for which Tested Chemicals were never billed. We want you to bill Tested Chem. immediately for this at the following reasonable rates $8 per hour for straight time for A.B. & M.M. per hour for straight time for M.M. 1½ time for overtime & double time for Sat. & Sun. (plus fare for & cash paid for this type of work). Compute the bill at average day of 14 Hours. During the week - 8 Hours straight bill & 6 Hours overtime. Also 6 Sat. & 6 Sun. at 14 Hours & double time. Plus interest at 6% on this bill. Also 6% interest on A.B. & M.M. investment which is 4 or 6 times as large as the others. Of course,

P.S - 4/24/51
N.A.N.

10/ N. H Markowitz

in order to do this properly, you'll have to demand & get promptly from Mark (Tested Chemicals, Inc) all agreements, resolutions, copies of minutes, financial statements (including profit & loss, & how much has been advanced or loaned to Corp. by various individuals, & how much each individual has paid for their stock), copy of license agreement (10¢ a lb.) with the Buttenwieser, & copy of (1st Par) prospectus noting that Pressing wanted to get Nasmi Brothers to put in $25,000 from bail money into the business, agreement whereby the Buttenwieser came into the Tested Picture — At this point I want to emphasize that a registered notice should be sent (prompt) to Tested Chemicals, Inc. cancelling the sale & the (patented) process ~~use~~ (a licensing agreement) by which (Tester) were making the product. This "provided for" payment of 10¢ a lb. Point out that the agreement is being cancelled for a number of reasons 1. Failure to pay. 2. Failure to stay in operation (3) No future, etc. Liquidation of Tested Chemicals can be accomplished by two methods (1) Sale of assets by unanimous consent of stockholders in bulk to private bidders (2) Sale of assets piecemeal or in bulk (whichever bid is higher) at a public auction sale.

With reference to #1, Brothman would very much prefer that before same takes place, that the other stockholders change places with Buttenwieser. Otherwise they could bring

all kinds of suits charging fraud (failure to [illegible] in some type of Jewish area claiming all sorts of verbal agreements with reference to [illegible] activities. (THEY are a "bad" kind.) I [illegible] of liquidation is the simplest to [illegible], but may be the most difficult because of the necessary agreement between the stockholders + Bottman. Alternative #2 fails because of inability to get very valuable releases from the Simmons, Messing, etc. Alternative #3 will be necessary. The disadvantage of plan 2 is that it is more expensive to carry out (custom [illegible] + it may bring [illegible] question of assignee. But we agree. Either alternative #2 or #3 is [illegible] the money invested. Under no circumstances should Messing ever be co-assignee. (By the way Bottman intends to secure Messing's return of money + the stock of Textile Enterprises.)

5. The [illegible] of the books + records, which are down at Foley Square, should be looked into. What are the Internal Revenue agents doing with them?

6. After you have digested this letter, + have met with Mrs Bottman, Claire Mosimann, + "writer M.M., You should arrange to bring A.B. + M.M. to Foley Square, so that they can discuss [illegible]

P.J. - 4/12/71

Hendrickson + with you. There is at present an injunction pending there, as they were brought down a couple of weeks ago regarding their fine. I hope it should not be too difficult to bring them down again on this writ for a new trial based upon my view of the following: (1) Straightforward fine (2) Non handling of appeal of 17.14 & you need both present —

P.J. By the way months ago A.B. asked Massey for his file, including agreements etc. Massey stalled several times for a couple of weeks & finally indicated that he wasn't going to give him the file. You must get Both's complete file from Massey, including (a) Agreement of A.B. with Lennox & Imperial Chemicals LTD. (which A.B. considers now null & void) (b) Agreement of A.B. associates with Industrial Process Engineers (LEWINSON) under which A.B. intends to sue for money due. → J.P.E. should be pressed now for money & accounting of funds owed A.B.A. (STORIES can be told of the Lennox practice of phony SHIPMENTS issued to BRANCHES + false STATEMENTS of what SHOULD + NOT shipped + of false amounts of orders on hand)

As you can readily see there is quite a bit of work to be done + to be done promptly. I'd just want to assure you at this time that you will be paid in full for your efforts & soon so please get started pronto. Thanks a lot. J.F.

FD-141
(7-1-48)

BULKY EXHIBIT

Date received [illegible]

[illegible]

100-95068-1[illegible]
(Title of case)

Submitted by Special Agent [illegible]

Source from which obtained [illegible]

Address [illegible]

Purpose for which acquired Investigation

Location of bulky exhibit In cabinet with file

Estimated date of disposition [illegible]

Ultimate disposition to be made of exhibit [illegible]

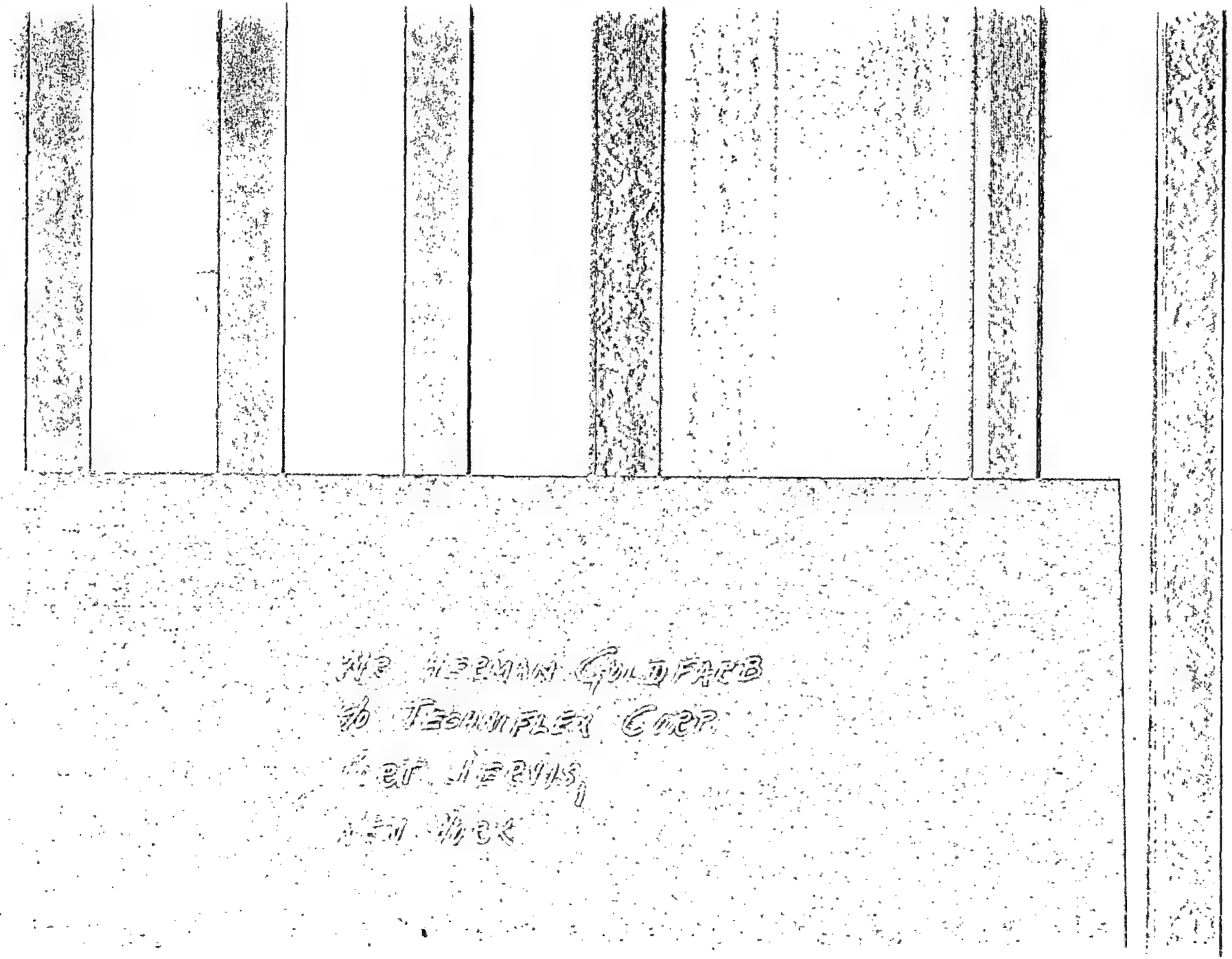
List of contents:

111. Two photostatic copies of letter written [illegible] to Norma Goldfarb.

66

100-95068-1B

SEARCHED ..... INDEXED .....
SERIALIZED ..... FILED
JUN 14 1951
FBI - NEW YORK



May 25, 1951

Dear Norman,

In the mail I passed you a few lines ago. Since supper I've dealt with the question of perspectives, and the details of how I am going on the sale of mining equipment. I'll tackle the question in just that order.

PERSPECTIVES:-

As you know, the items we have discussed and standardized are Powered Valves (Motor-Operated Valves and the Radius Valve); Instruments (the Capacitance Antenna Current and the Liquid Level Control); Mining Equipment (the Rotary Vacuum Filter and a proposed Horizontal Centrifuge).

Let's look at these, firstly, from the standpoint of "group perspectives", and then from the standpoint of individual perspectives.

From the overall group perspective, the Powered Valves and Instruments form a ground approved, partial and complete Refrigeration [illegible] Next Week by the time you have read the November and December 1950 articles on Refrigeration.] In reading that I got on the telephone to several groups of engineers at the Port, Warrants, General Radio Works, and Plastic Chemical on the subject of Refrigeration courses and that partial and complete Refrigeration forms a great feature in the chemical industry.

By "partial refrigeration" I mean the embodying of gain expenses of operations within an individual process, perhaps just the ambient expenses within the unit and thus to some or some powered control. What I mean by "complete refrigeration" is typified by the plant discussed in the second of the two Refrigeration articles.

Rectified tubes, valves, tubes, pentodes, pentode tubes, and valves, pentode valves, triode pentodes, pentode triodes, pentode valves, pentode valves, pentode valves, pentode valves, pentode valves, pentode valves. I discussed the shortcomings and the advantages of these in a previous communication, and I would suggest that you consult that method again. But, for the present purpose of this discussion, it is only necessary to point out that the most unsatisfactory of the usual categories of valves at their present state of development are the screened valves and the pentode valves. The screened valves suffer from a considerable commitment to "on-off" operation; the comparatively low power ranges in which they are adapted, and by their group heating transmitter "low reading qualities" (that is, as a group, they are not classed as light-heating). The pentode valves suffer from a poor adaptability to Mutual conductance control.

The Packton Valve on which we are working is, I believe, a valid attempt to overcome the above mentioned shortcomings of the valves as a whole. Certainly, it affords higher reading factors than those previously known although with screened, and by this alone has a longer range of Dick-and-Bat arrangement with range. The higher mutual factor quality and the "low reading qualities" of this head-on I have in particular but that it also made for higher reading factors than ever previously known although with "pentode" type screened. In the full range Mutual model of our Packton Valve, it also puts forth a type of waves (that is, Mutual and modulation contact) never before attempted with screened valves. And, finally, it seems to me that our Packton has a better adaptability to fabrication in a wide range of

valve. Now any of the valves with which I am familiar [Expand] is expands, the "full area" width of the passage, to open the compound bridge principle, [Example] a wide range of variations which we might furnish in connection with this model.]

Now, as to the motor operated valve on which we have been working. This is not getting away from the fact that of all the conventionally employed power valves, the electric motor operated does in fact until it need light-shutting applications. Yet even the popularly employed diaphragm motor valve suffer from "line pressure conditions." The motor operated valve on which we have been working under an adjustment, and is especially adapted to the necessity of making this valve suitable for "throttle and modulated control."

Now, you will see that the driving power in the last valve which we have described is the pilot area of the piston in the power valve for holding this shut. This area, as I have shown, is governed in the relation of the application of these valves suitable of holding this.

Now, I am introducing instruments as a second main category of Rotary Compressors. Instruments as used in Rotary Type are properly divided into three main sub-groups "on-off" Type, and "throttle or modulating" control Type. "On-off" Type are almost exclusively connected known as "pressure" operated, governing the point beyond from which motor valves of various types are called into operation. In "throttle or modulating" Type are the most important in connection with Rotary Pumps.

Thus far, we have made only passing reference to the question of

instruments, and they have been assigned to the "on-off" type, having all the class of instrument in the smallest possible number. The shortcomings of the conventionally available types are that they possess a very low order of accuracy, are keyed to control around a single control point (or range around a single control point), and are frequently entirely undependable. We spoke of the "on-off" type as "fine signal generators" lacking the pick-ups. As such, complete dependability, high accuracy and simple adjustment are demanded. The ability to give instruments of this type the multi-point control would be a step advance.

The liquid level control unit which I provided you is an attempt to plug one of the most flagrant gaps in the "on-off" field with a dependable, low cost instrument. In the further material which will reach you on this instrument, you will notice that the instrument will be adapted to multi-point control (and, in some models, indication).

The capacitance antenna circuit which we have discussed has been an attempt to achieve high accuracy, stable, and dependable control in connection with mercury column instruments such as thermometers and manometers. [The possibilities of the capacitance antenna instrument in connection with vacuum manometers as an end instead of an aid to mercury column instruments.] The further work that I shall do on the capacitance antenna principle will be towards arranging the instrument as a multi-pointed control feature as well.

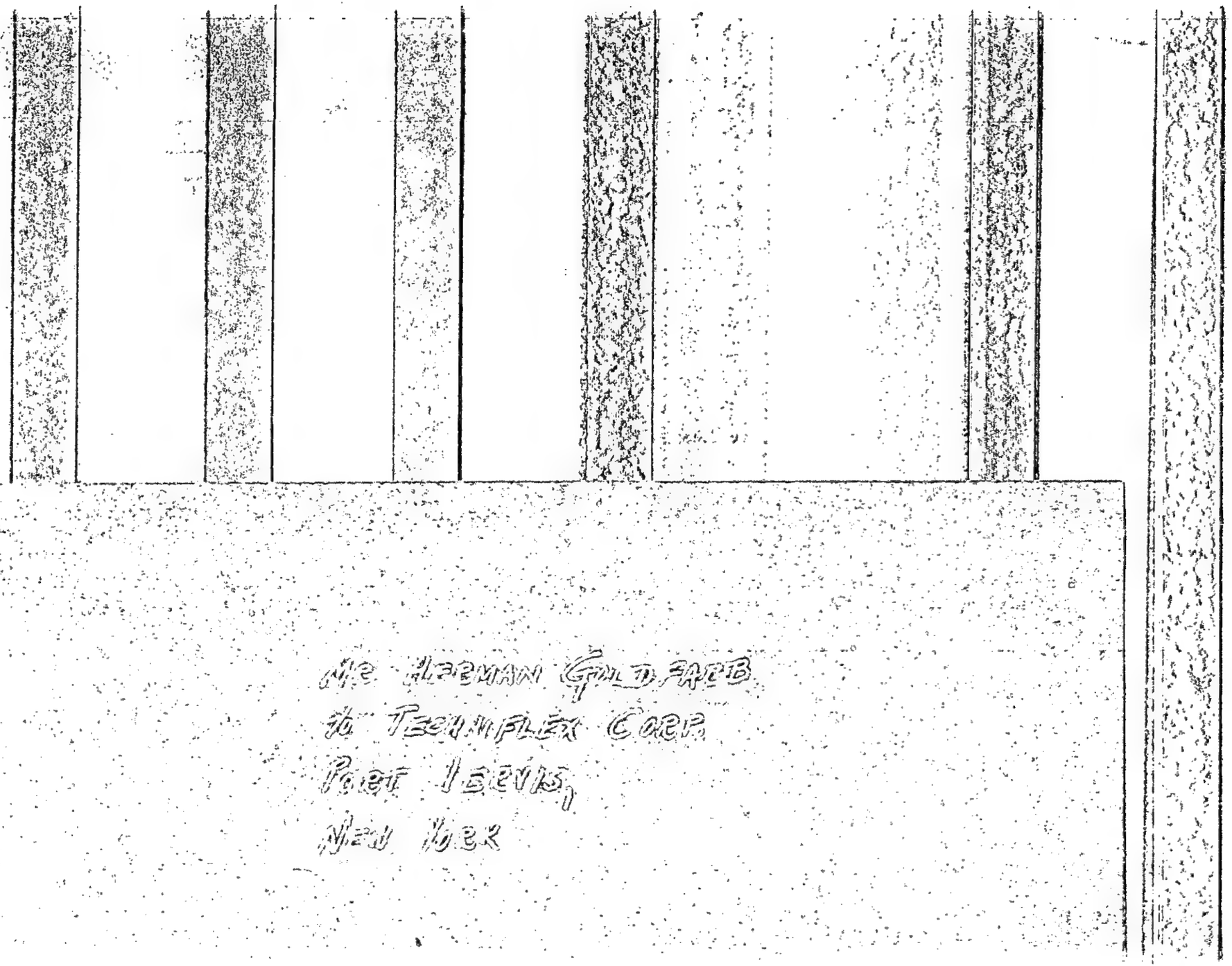
Generally speaking then, the goal as regards "on-off" type instruments will be to get stable, dependable, and high accuracy control, in combination with the feature of multi-point control. Finally, the goal will be to improve the type of manual

data. Conventional "on-off" instruments to expand to double existing four
[illegible] coordinate as [illegible], [illegible], etc. [illegible]
[illegible] "prime signal" [illegible] [illegible]
[illegible] the potential of "on-off" instruments to "prime signal" systems would
[illegible] more than increasing the accuracy, their dependability, and their
stability. It would involve developing a class of instruments which respond
to the rate of variation of given process coordinates (in other words, it would
involve the development of a class of derivative-action "on-off" instruments).
We must then be a further goal of our work in the field of instruments.
[(At some future time, it might be a point from the Kaplan Aircraft
accomplished derivative-action "prime signal" with conventional-quality
equipment. Just when it would be [illegible] of a diagram.)]

The third principal component of Refinery Systems consists of
"[illegible] or modulating" control type instruments. These [illegible] the [illegible]
completed process control.

Now the main has come, and I have to close the
abruptly. Just let me say that I'll be the first of many, back
letting up where the previous one left off.

Yours,
Jake



MR. HERMAN GOLDFARB
% TECHNIFLEX CORP.
PORT JERVIS,
NEW YORK

May 25, 1951

Dear Norman,

In the past I promised you a few lines on how I would deal with the question of perspectives, and the details of our strategy in the sale of mining equipment. I'll tackle the questions in just the order.

PERSPECTIVES:

As you know, the items we have discussed and shall discuss (Power Valves (Motor Operated Valves and the Needle Valve); Instruments (the Capacitance Antenna Current and the Liquid Level Control); Mining Equipment; the Rotary Vacuum Filter and the proposed Magnetic Centrifuge.

Let's look at these, firstly, from the standpoint of "group perspectives" and then from the standpoint of individual perspectives.

From the market growth "group perspective", the Power Valves and Instruments form a ground approach to partial and complete Refrigeration. I'm sure that by this time you have read the November and December 1950 articles on Refrigeration. I. He mentions that I got on the talk that I showed the group of engineers at the Port, Minerals, General Analytical Labs, and Pilot Chemical on the subject of Refrigeration. Everyone on that talk partial and complete Refrigeration have great future in the chemical industry.

By "partial refrigeration", I mean the outstanding of given expenses of operations within an entire process, perhaps just the actual expenses which the unit and less to some or less amount control. What I mean by "complete Refrigeration" is typified by the plant discussed in the second of the two Refrigeration articles.

Retrograde motion, power valves, power controls, and adjustable systems. The range of powered valves has my initial consideration during the operation, power-grade operated valves, solenoid valves, and manual operated valves. I discussed the advantages and the value of each of these in a previous communication, and I would suggest that you consult that material again. But, for the brief purpose of this discussion, it is only necessary to point out that the most satisfactory of the mod cadyonics of valves at this present state of development are the solenoid valves and the electric motor operated valves. The solenoid valve suffers from a substantial constraint to "on-off" operation. The comparatively low pressure ranges in which they are adapted, and by this group I am using to mean "low sealing qualities" (that is, as a group, they are not classed as tight-sealing). The electric motor operated valve has suffered from a poor adaptability for flexible or variable control.

The Paddon Valve on which we are working is, I believe, a valve attempt to overcome the above-mentioned shortcomings of the solenoid class as a whole. Certainly, it affords higher sealing factor than previously been attempted with solenoids, and by this does bring a larger range of disk-and-seat arrangement into play. The higher sealing factor quality and the "low sealing qualities" objection I had in mind in my question but that it also made for higher sealing factor than has ever previously been attempted with "paddon" type solenoids. In the "full range flexible" model of our Paddon Valve, it also cuts for a type of service (that is, flexible and variable control) never before attempted with solenoid valves. And, finally, it seems to me that our Paddon has a better adaptability to fabrication in a wide range of

available. Here any of the solenoid-with which I am familiar. [Especially expensive, the "full range Weston" meter of the Jewell, as you use the expensive bridge principle, a wide range of instruments which are suitable for comparison with this meter.]

Now, as to the meter operated valve on which we have been working. That is not getting away from the fact that of all the conventionally-operated valves, the electric meter operated valve is best suited to rapid-flight applications. It Even the regularly-employed displacement valve suffers from "slow reading qualities". The meter operated valve in which we have been working makes an adjustment, and is especially adapted to the necessity of making this valve suitable for "flutter and modulated control".

Now, you will see that the driving pumps in the test valve which we have described in the early part of the paper in the range of powered valves for Robertson duty. This does not mean, however, that you should be discouraged by the application of these valves outside of Robertson.

Now, I mentioned instruments as a second main category of Robertson procedure. Instruments as used in Robertson are usually classified into two main categories "on-off" types, and "flutter or modulating" control types. On-off types are almost exclusively connected to "prime signal" practice, meaning the part signals from which control systems are called into operation. The "flutter or modulating" types are the real key instruments in explorer procedure.

Thus far, we have made only the vaguest reference to the question of

instruments, and thus should be confined to the "on-off" type. Looking at the class of instrument in the market presently encountered, the majority of the conventionally available types are those employing a degree of accuracy designed to control around a single control point (or range around a single control point), and are frequently satisfactory for the problem. We speak of the "on-off" type as those signal generating instruments of such simplicity, dependability, high accuracy, and simple adjustment and demands. The ability to give instruments of this type a multi-point control would be a step advance.

The liquid level control with which I provided you is an attempt to play one of the most elegant gaps in the "on-off" field with a dependable, low cost instrument. In the further material which will come for us in this instrument, you will notice that the instrument will be adapted to multi-point control (and, in some models, indicator). The capacitance antenna element which we have discussed for this is an attempt to achieve high accuracy, stable, and dependable control in connection with mercury column instruments such as thermometers and manometers. [The possibilities of the capacitance antenna instrument in connection with vacuum manometers are one such instance of its application to mercury column instruments.] It further ends that I shall discuss the capacitance antenna principle will be found equally applicable giving the instrument a multi-point control feature as well.

Secondly, under this, the goal as regards "on-off" type instruments will be to get stable, dependable, and high accuracy control, in combination with the feature of multi-point control. Thirdly, the goal will be to increase the type of [illegible]

date. Conventional "on-off" instruments respond to absolute values of some process coordinate (e.g. pressure, temperature, etc.) ~~that is the output of the instrument is~~ ~~"on" or "off" depending on whether the process coordinate is above or below the setpoint~~. Instruments of "on-off" instruments as primary signal sources would involve more than increasing the accuracy, the dependability, and the reliability. It would involve developing a class of instruments which depend for the rate of variation of given process coordinates (in other words, it would involve the development of a class of derivative-action "on-off" instruments). We must then be a further goal of research in the field of instruments. [At some future time, it might be a point to use the higher-level more accomplished derivative-action "prime signals" with conventionally-available equipment. Just what it would be [illegible] of a diagram.]

The third principal component of Ratio-Trol systems consists of "position or modulating" control type instruments. These are called the final or completed process control.

Sorry the weakness has come, and I have to close the abruptly. Just let me say that I will be the first of any such thing as where the previous one left off.

Yours,

Jake

FD-141
(7-1-48)

BULKY EXHIBIT

Date received 6/7/51

[illegible]

100-95068-1B
(Title of case)

Submitted by Special Agent [illegible]

Source from which obtained [illegible]

Address [illegible]

Purpose for which acquired Investigation

Location of bulky exhibit [illegible]

Estimated date of disposition To be decided at conclusion of case

Ultimate disposition to be made of exhibit Retain

List of contents:

112. Copy of Marshal's return to Writ of Habeas Corpus.
Copy of affidavit of [illegible] Foley.

67

100-95068-1B

SEARCHED ... INDEXED ...
... FILED ...

- -X

U. [illegible], ex rel.
[illegible] and [illegible],

Relators,

- v.-

[illegible], United States
Marshal for the Southern District of
New York, [illegible], Warden,
Federal House of Detention, [illegible]
COLLINS, Warden, Tombs House of
Detention,

Respondents.

- -X

AFFIDAVIT

STATE OF NEW YORK)
COUNTY OF NEW YORK) ss.:
SOUTHERN DISTRICT OF NEW YORK)

[illegible], being duly sworn, deposes and says:

I am an Assistant United States Attorney for the Southern District of New York, and as such am familiar with the above-entitled prosecution and the facts pertinent thereto.

The relators herein are lawfully in the custody of the United States. The defendant ABRAHAM BROTHMAN [illegible] having conspired to violate Section 241 [illegible] violated Section 241, (18 U.S.C. §§ 88, 241 [illegible]) defendant MIRIAM KOPOWITZ was convicted [illegible] Section 241 (18 U.S. §88, [illegible] ABRAM BROTMAN received a [illegible] imprisonment and a committed fine; [illegible] KOWITZ received a [illegible] and a fine of $2,000.

The relators' petition that [illegible] to meet and confer [illegible] partnership tax returns [illegible] set forth.

JLR:ak
114902

A writ of habeas corpus is intended to pro and secure to a right which has been or which is about to be taken away, which right cannot be protected through other procedure. Obviously, if no right exists, a wri habeas corpus is unavailing. Indeed it cannot serious argued that it affords a procedure through which perso in custody may seek favors. An examination of the pet in support of the instant writ demonstrates the frivol nature of the writ and conclusively established that n right of the relators was, is or will be in jeopardy.

As herein noted, a meeting of relators is sought so that they might prepare income tax returns. petition recites that Hoshowitz supervised the keeping the books and records of the partnership, A. Brothman Associates. If this is the fact, deponent fails to se why she, a partner in the enterprise, is not fully qua fied to prepare the necessary returns. A meeting of a partners has never been required in order that a tax r be prepared; business dictates do not require this. I some peculiar problem or difficulty exists or if the r tor Brothman desires to examine the returns prior to t filing, there is no reason why that cannot be arranged without a meeting. Further, it is noted that there is showing in the relators' petition that this partnersh business requires their personal attention. Deponent su that the nature of the business sought to be transacte this fourth use is customarily taken care of by an acc ant or by counsel. If such a person is not available, five has other members who are fully qualified and jus such obligated to file the tax returns as are relators Thus make the relief requested entirely unnecessary.

JJF:gk
11490

The "request" before the court is the firs
its nature recorded in the files of the United States
Attorney for this district. It is unheard of that the
exists a right which may be secured by writ of habeas
corpus for prisoners to meet and confer in a federal c
house for the purpose of conducting their businesses.

The instant writ has no basis in law or in
and should be dismissed.

Sworn to before me this
25th day of May, 1951.

J.
1
C 133-106

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

- -x

UNITED STATES, ex rel.
ABRAHAM BROTHMAN and MIRIAM MOSKOWITZ,

Relators,

-v-

WILLIAM A. CARROLL, United States Marshal for the Southern District of New York, EDWARD S. THOMPSON, Warden, Federal House of Detention, MISS RUTH COLLINS, Warden, Women's House of Detention,

Respondents.

RETURN O
HABEAS

- -x

STATE OF NEW YORK)
COUNTY OF NEW YORK) ss.:
SOUTHERN DISTRICT OF NEW YORK)

WILLIAM A. CARROLL, being duly sworn, depo
and says:

I am the United States Marshal for the So
District of New York. I make this return to the wr
habeas corpus heretofore allowed to the relators AB
BROTHMAN and MIRIAM MOSKOWITZ on relators' petition
verified the 22nd day of May, 1951.

The relator ABRAHAM BROTHMAN is presently
confined at the United States Federal House of Dete
427 West Street, New York City, under a judgment of
viction and sentence entered in the United States D
Court on November 28, 1950. The relator ABRAHAM BR
was convicted for having conspired to and with viol
the obstruction of justice statute, 18 U.S.C. §§88,
(1946 Ed.). BROTHMAN received a sentence of seven
imprisonment and a committed fine of $15,000.

The relator MIRIAM MOSKOWITZ was charged
BROTHMAN in the same indictment, with having conspi
to violate the obstruction of justice provision. Sh
convicted with BROTHMAN and received a sentence of

JMF:ms/mz
114
C155-106

years imprisonment and a committed fine of $10,000.

Upon the attached affidavit of John M. Foley, Assistant United States Attorney, and upon deponent's knowledge, the detention of ABRAHAM BROTHMAN and MIRIAM MISKOWITZ is in all respects lawful.

WHEREFORE, it is prayed that the writ of habeas corpus be dismissed.

Sworn to before me this

day of , 1951.

FD-141
(1-18-48)

BULKY EXHIBIT

Date received 6/1/51

[illegible] PRATT, was

100-95068-1
(Title of case)

Submitted by Special Agent JOHN R. COLLINS

Source from which obtained [illegible] T. [illegible]

Address [illegible] Federal Detention Headquarters

Purpose for which acquired Evidence

Location of bulky exhibit - In cabinet with File

Ultimate disposition to be made of exhibit [illegible]

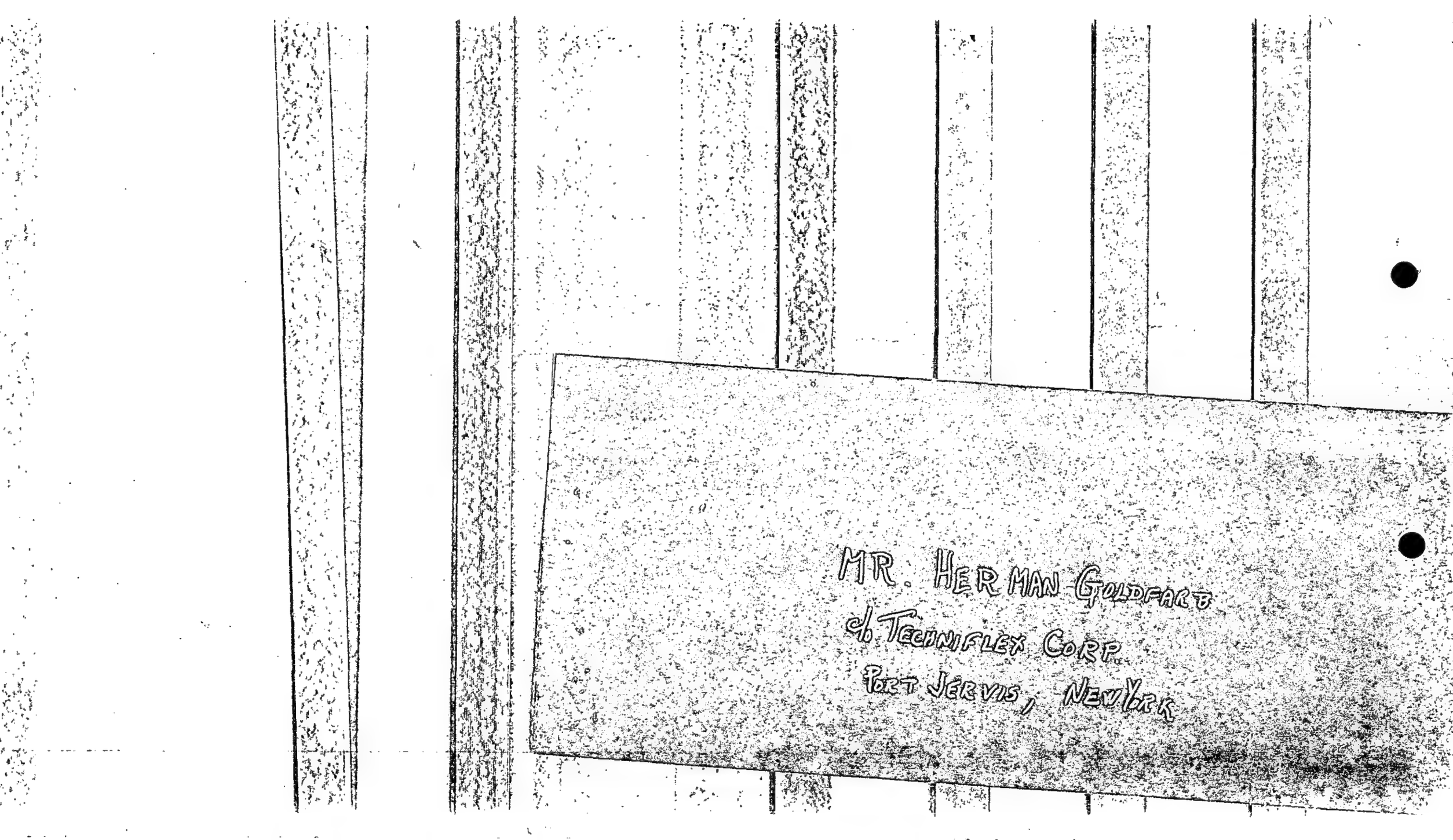
Estimated date of disposition - To be destroyed upon conclusion of case

List of contents:

1). One photostatic copy of letter written by [illegible] to Herman Goldfarb.

68

100-95068-1B


MR. HERMAN GOLDFARB
c/o TECHNIFLEX CORP.
PORT JERVIS, NEW YORK

June 7, 1951

Dear Thomas,

When I last saw you, I mentioned some typos in th
originally submitted Position Finder Calculation Forms. Since I c
below without further radio.

* * * * * * * * * *

Equation (23) on Page 6, which of
form

$$f = 2L(\cos\theta - \cos\theta_1)$$

is only a close approximation for th
rather than an absolutely true relation
defining the displacement during th
angle travel. Eq. (23) expresses th
that the reading of the displacement
all times occur in a plane which co
to the main arm of plate "A", and
Eq. (23) expresses the fact that true direction of deflection of the
for all positions (other than two) would have vertical as well as
horizontal components. At two positions at which the vertical com
would be zero would be:

a. In arm Number $\theta = 0°$

and

b. " " " " the load (P_2), applied by plate "B
the arm main axis of the displacement bar arrang
of zero.

Assuming the conditions under the diagram above for

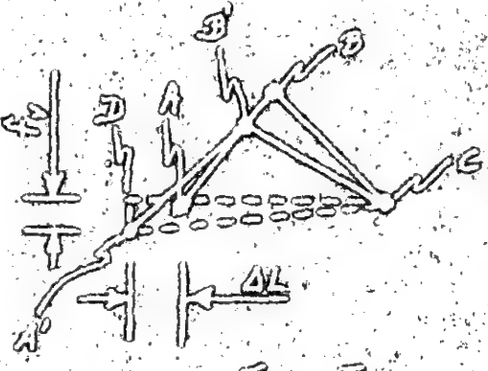


Fig. 2

Let us

a. $\overline{BC}$ be the line "c" when $\theta = \theta_1$

b. $\overline{BC'}$ " " " " $\theta =$ any other value of θ other than $\theta = \theta^\circ$

c. $\overline{DA}$ be the line "A" when $\theta = \theta_1$

d. $\overline{DA'}$ " " " " $\theta =$ any other value of θ other than $\theta = \theta^\circ$

e. $\overline{CD}$ be the line connecting the points "A" and "C" when $\theta =$

f. point (A') represent the new position of the midpoint of $\overline{AB}$ after a rotation when $\theta = \theta_1$ and $\theta =$ any other value of θ other than θ°

g. $\overline{DA'}$ be a line connected to $\overline{BC}$ and originating at "D"

h. $\angle DCA = \theta_1$

i. $\angle DCA' =$ any other value of θ other than $\theta' = \angle\theta$

j. $\angle DCA' =$ the angle formed between $\overline{CD}$ and $\overline{CA'}$

and k. point (C) represent the anchor point at the center point "C"

Applying the force to the midpoint of the triangle, the force would cause the line to move the "locking angle" about the rotation from (A) to (A'). This would create a triangle of the said midpoint (AL) and a vertical line of the line, the hypothenuse between (A) and (C) with a value of

$$\overline{AL} (\sin \theta_1)$$

and would horizontal with a line between (C) and (A')

$$\overline{AL} (\cos \theta)$$

The distance $\overline{AL}$ (F_1) would be given by

$$f_0 = 2f \sin\theta \sin\theta_1 \cos\theta_1$$

and also

$$\Delta L + 2f \sin\theta_2 = 2f \cos\theta \sin\theta_1$$

and

$$2f(\sin\theta \sin\theta_1 - \sin\theta_2) = \Delta L$$

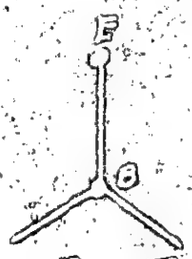


FIG. II

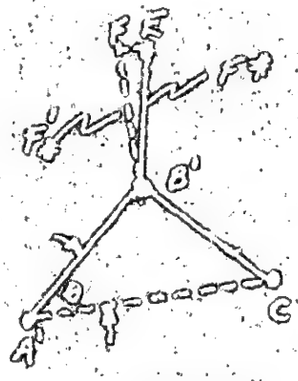


FIG. III

In Fig. II, if O also just touches BB' and the ... of Fig. II corresponds to ... length measured from by ADAC in Fig. ... and O' a force is applied normal to AC ... Fig. III corresponds to the final condition when ... A O' A' C in Fig. I, then force (F) applied ... B' by fixed O' (represented above by EB' ... section FO' represents a force (F') such ... F' would be three components of (F) normal to ... to AC. The force (P) applied by O'A' to ... frictionless midpoint A' would, it is clear, ... by

$$\frac{F'}{\sin\theta} = P$$

which (F') would be given by

$$F' = F \sin\theta_1$$

and

$$\text{if } EO'F \text{ would equal } \theta_1$$

It is clear that the vertical deflection (f_v) would be represented by ... and would be given by

$$f_v = \frac{Fl^3}{3EI}$$

Comparing Eq. (2) & Eq. (3), we get

$$F_T = \frac{P_2 L_2}{4\pi\varepsilon_0 \cos\theta_T}$$

Comparing the vertical components of Eq. (2), we get

$$F_T = \frac{2P_1 L_1^3 \sin\theta}{4\pi\varepsilon_0 \cos\theta_T}$$

Equating the right-hand side of (4) to the right-hand side of Eq. (5), we get

$$2P_1 \cos\theta \sin\theta_T = \frac{P_2 L_2^3 \sin\theta}{4\pi\varepsilon_0 \cos\theta_T}$$

or

$$\frac{4\pi\varepsilon_0 \cos^2\theta}{L_1^3} = \frac{P_2}{\sin\theta_T \cos\theta_T}$$

is the relationship governing θ, θ_T, and P_2 during the "take off". By this, Eq. (6) would take the form

$$2L\left(\cos\theta \frac{P_2 L_2^3}{4\pi\varepsilon_0 L_1^3 \cos\theta_T} - \cos\theta_1\right) = \Delta L$$

or

$$2L\left(\sin\theta \frac{P_2 L_2^3}{4\pi\varepsilon_0 L_1^3 \sin\theta_T} - \cos\theta_1\right) = \Delta L$$

is the most correct form.

Observing Eq. (1) in the form

$$\frac{4\pi\varepsilon_0 L_1^3 \cos\theta \sin\theta_T \cos\theta_T}{P_2} = P_1$$

It is clear that, when $\theta = \theta_1$ and when, however, $P_2 = 0$, $(\sin\theta_T \cos\theta_T)$ would be zero. It yields a smaller component to the tangential position ΔBAC in Fig. 1; and

showing Eq. (2) in its form

$$\frac{4\pi E^2 L \cot\theta}{L_1^3} = \frac{P_2}{\sin\varepsilon_T \cos\varepsilon_T} \qquad (2)$$

It is absolutely clear that when $\theta = 0°$, and hence $\cot\theta = \infty$, since P_2 would still have a finite value, ($\sin\varepsilon_T$ and $\cos\varepsilon_T$) would perforce be equal to zero, thus defining a condition in which $\varepsilon_T = 0°$ — which is to be expected and desired.

The actual deflection of the diaphragm must then be considered as

$$\left[f_v^2 + \Delta L^2\right]^{\frac{1}{2}} = f \qquad (4)$$

and, it follows, that all of the relationships which are shown on Fig. (3) as given in the 'Calculation Form' must accordingly be adjusted to be in accordance.

* * * * * * *

The machine has called again, and this time must stop. She is being carried from one hotel to another, so that it's just a matter of getting accustomed to sleeping into a different bed each night.

I'm not sending the drawings for the Parallax Valve, or Detector, at which from the drawing for the Parallax Valve, the calculations for its model, and the failure of this will have until it. I'm not sending the drawings for the Rocket, or the calculations for it, today, because I would like to correct a repetition of the condition that I had intended to correct.

Please bear with me, and keep plugging.

Yours very truly,

AL

FD-141
(1-18-48)

BULKY EXHIBIT

Date received 6/2/51

[redacted]

100- 95068-1B
(Title of case)

Submitted by Special Agent John R. Collins

Source from which obtained [redacted]

Address Federal Detention Headquarters

Purpose for which acquired Evidence

Location of bulky exhibit [redacted]

Ultimate disposition to be made of exhibit Retained

Estimated date of disposition - To be determined after disposition of case

List of contents:

114. Photostatic copy of letter addressed to [redacted] from A. Brotman, dated 5/31/51.
115. Photostatic copy of letter addressed to [redacted] from A. Brotman, dated 5/31/51.
116. Photostatic copy of [redacted] "The Valve of a Type Packless Valve.
117. Photostatic copy of letter dated /10/51 addressed to Jerome D. Barbour from A. Brotman.

69

100-95068-1B

June 10, 1951

Dear Norman,

The following is a continuation of my note of June 7th, and I hope this will complete the job.

Page 3 line 5 of my note of June 7th was written with the evidence bearing down my neck. On the present, I wish for the opportunity to clarify the mathematical statement, before I continue with the rest of what I intended to write.

At the bottom of Page 3, it is stated that "It is clear that the natural deflection (f_1) would be proportional to (F)". This is apparently only true, but the condition that (f_1) is given by

$$f_1 = \frac{FL^3}{48EI}$$

as per Eq. (VI) is to know. Consider Fig. III. Fig. III contains 5 force diagrams, (a), (b), (c), (d), and (e). Force diagram (a) contains the force $(P_2)_a$ with respect to $\overline{AC}$ as a reference axis. Force diagram (b) contains $(P_2)_b$ with respect to $\overline{GC}$ as a reference axis. Force diagram (c) contains $(P_2)_c$ with its components with respect to $\overline{AC}$ as a reference axis, which force diagram (d) contains the same force with its components with respect to $\overline{GC}$ as a reference axis. Force diagram (e) contains force $\overline{BB'}$ and $(F_1)_d$ with its components with respect to $\overline{AC}$ as a reference axis.

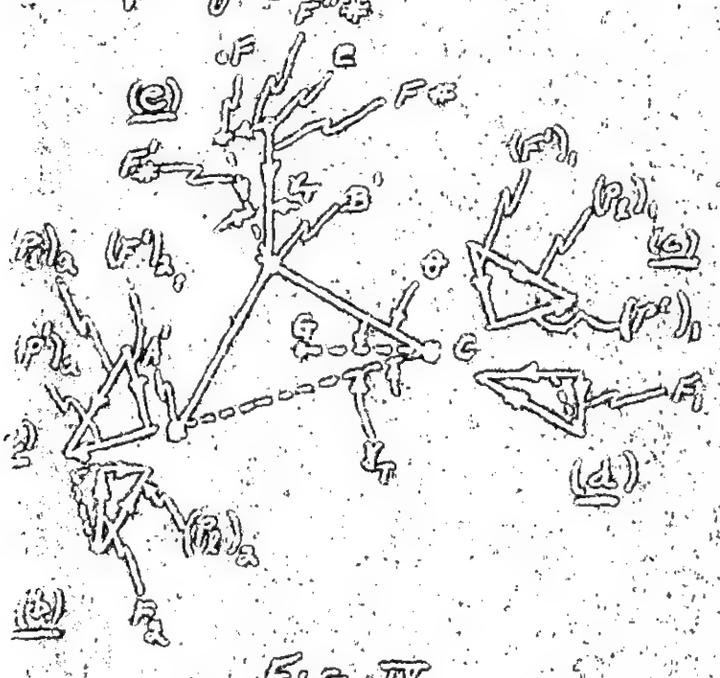


Fig. III

Observing force diagram (c), we see, especially, that force which is designated by $(F'')_T$, it is observed that

$$(P')_2 - (P')_1 = F'' \tag{1-A}$$

or

$$(P')_2 = (P')_1 + F'' \tag{2-A}$$

By this, we may write

$$(P_2)_2 = \frac{(P')_1 + F''}{\cos\theta} \tag{3-A}$$

by reference to force diagram (a); and

$$(P_2)_1 = \frac{(P')_1}{\cos\theta} \tag{4-A}$$

by reference to force diagram (c). We observe that

$$F' = F \sin\gamma_T \tag{5-A}$$

Also, by reference to force diagram (b),

$$F_2 = (P_2)_2 \cos\{90 - [\theta + \gamma_2]\} = (P_2)_2 \sin(\theta + \gamma_2) \tag{6-A}$$

and

$$F_1 = (P_2)_1 \cos\{90 - [\theta - \gamma_1]\} = (P_2)_1 \sin(\theta - \gamma_1) \tag{7-A}$$

by reference to force diagram (d). And, since

$$F_1 + F_2 = F \tag{8-A}$$

it follows that

$$\frac{(P')_1 + F'}{\cos\theta} \sin(\theta + \gamma_2) + \frac{(P')_1}{\cos\theta} \sin(\theta - \gamma_1) = F \tag{9-A}$$

$$\frac{(P')_1 + F\sin\gamma_T}{\cos\theta} \sin(\theta + \gamma_2) + \frac{(P')_1}{\cos\theta} \sin(\theta - \gamma_1) = F \tag{10-A}$$

which would lead to

$$(F')_1 (\sin[\theta+\gamma_1] + \sin[\theta+\gamma_1]) = F(\cos\theta - \sin\gamma_1 \sin(\theta+\gamma_1 \quad (VI.A)$$

and

$$(F)_1 = \frac{F(\cos\theta - \sin\gamma_1 \sin[\theta+\gamma_1])}{\sin[\theta+\gamma_1] + \sin[\theta-\gamma_1]} \quad (VII.A)$$

or, on the other hand,

$$F = \frac{(F')_1 (\sin[\theta+\gamma_1] + \sin[\theta-\gamma_1]}{\cos\theta - \sin\gamma_1 \sin[\theta+\gamma_1]} \quad (VIII.A)$$

By the logic, it will be found that

$$F_2 = \frac{F(\cos\theta - \sin\gamma_1 \sin[\theta+\gamma_1]) + F\sin\gamma_1 \sin(\theta+\gamma_1)}{\cos\theta(\sin[\theta+\gamma_1] + \sin[\theta-\gamma_1])} \quad (VIII.A)$$

and, since

$$(F')_2 = \cos\gamma_1 F_2, \quad (IX.A)$$

then

$$(F')_2 = \frac{F(\cos\theta - \sin\gamma_1 \sin[\theta+\gamma_1)) + F\sin\gamma_1 \sin(\theta+\gamma_1)\cos\gamma_1}{\cos\theta(\sin[\theta+\gamma_1] + \sin[\theta-\gamma_1])} \quad (X.A)$$

Since the deflection (γ_1) would be proportional to $(F')_2$, which is a fixed moment to the axis $A'C$, it follows that

$$\gamma_1 = \frac{(F)_2 L_1}{AEI} =$$

$$\frac{L_1^3 \{[F(\cos\theta - \sin\gamma_1 \sin[\theta+\gamma_1]) + F\sin\gamma_1] \sin(\theta+\gamma_1)\cos\gamma_1\}}{3EI\cos\theta(\sin[\theta+\gamma_1] + \sin[\theta-\gamma_1])} \quad (XI.A)$$

But, by Eq. (C) of my note of the 4th,

$$\gamma_1 = 3L\cos\theta\sin\gamma_1 \quad (C)$$

Thus, it follows that

$$L_1^3\{[F(\cos\theta-\sin\gamma_T\sin[\theta+\gamma_T])+F\sin\gamma_T]\sin(\theta+\gamma_T)\cos\gamma_T\}$$

$$=EI\cos\theta(\sin[\theta+\gamma_T]+\sin[\theta-\gamma_T]) \quad (19A)$$

$$=2L\cos\theta\sin\gamma_T$$

and also

$$\cos\gamma_T=\frac{96LEI\cos^2\theta\sin\gamma_T(\sin[\theta+\gamma_T]+\sin[\theta-\gamma_T])}{L_1^3\sin(\theta+\gamma_T)F(\cos\theta-\sin\gamma_T\sin[\theta+\gamma_T]+F\sin\gamma_T)} \quad (19A)$$

So we finish the write Eq (E) of the orig Eq 4th

$$2L\left[\frac{96LEI\cos^2\theta\sin\gamma_T(\sin[\theta+\gamma_T]+\sin[\theta-\gamma_T])}{L_1^3\sin(\theta+\gamma_T)F(\cos\theta-\sin\gamma_T\sin[\theta+\gamma_T]+F\sin\gamma_T)}-\cos\theta_1\right]$$

$$=\Delta L \quad (20A)$$

From Eq. (19A), it is apparent that whenever the force (F) decreases to a value of zero, ($\sin\gamma_T$) would of necessity have to take on a similar value, (γ) would have a value of zero, namely at first, when $\theta=\theta_1$ and when $\theta=0^\circ$, and hence, the vertical deflection of the spring weight would occur when the first limits of the "locking angle" would be attained.

For any angle of spring-lift which would be attained to less than the allowable limit, it is abundantly obvious that in view of the corresponding value of θ involved when the "locking angle limit" is performed, (γ_T) would involve very small values. It therefore seems as a practical approximation that

$$2L(\cos\theta-\cos\theta_1)=\Delta$$

as per Eq (20) of the original "Calculation Form."

By Eqs. (3.1), (3.2), and (3.3), the second term within the brackets of Eq. 3.7, namely

$$\frac{48EI}{L_0^3} \cdot \Delta L (\sin\theta - \sin\theta_1) = AF = \sin\theta \frac{F}{2} \tag{3.11}$$

When Eq. 3.11 is substituted into Eqs. (3.5) and (3.6) for Eq. (3.7), and simplified, we get

$$\frac{192EIL}{L_0^3} (\sin\theta - \cos\theta_1 \tan\theta) = F \tag{3.12}$$

and is proper. However, in the location of the value of θ at which (F) is a maximum, we must differentiate. The correct method is given below:—

Differentiate (F) with respect to (θ), and we obtain

$$\frac{192EIL}{L_0^3} (\cos\theta - \cos\theta_1 \sec^2\theta) = \frac{dF}{d\theta} \tag{3.13}$$

Setting $\left(\frac{dF}{d\theta}\right)$ equal to zero, we obtain

$$\cos\theta = \cos\theta_1 \sec^2\theta \tag{3.14}$$

or

$$\frac{\cos\theta}{\sec^2\theta} = \cos\theta_1 = \cos^3\theta \tag{3.15}$$

$$\cos\theta_K = \cos^{1/3}\theta_1 \tag{3.16}$$

value ($\cos\theta_K$) denotes a point on the plot of θ vs. F at which $\left(\frac{dF}{d\theta}\right) = 0$. But that value ($\cos\theta_K$) denotes a maximum or a minimum, we may differentiate Eq. (3.1) for a second time, and we obtain

$$\frac{192EIL}{L_0^3} (-\sin\theta - 2\cos\theta_1 \tan\theta \sec^2\theta) = \frac{d^2F}{d\theta^2} \tag{3.17}$$

We clearly negative value of the second derivative implies a maximum. The clearly positive value of the second derivative implies a minimum. Thus (θ_K) denotes a value of θ at which (F) is a maximum.

The corresponding value for (θ_K) obtained as in Eq. (3.6) is the required undeformed length from which Eqs. (3.6) & (3.7) were derived.

By normal procedure, if

$$\cos\theta_K = \cos^{1/3}\theta_1 \qquad (3.5A)$$

then

$$\cos^2\theta_K = \cos^{2/3}\theta_1 \qquad (3.6A)$$

and

$$\sin\theta_K = \left[1 - \cos^{2/3}\theta_1\right]^{1/2} \qquad (3.7A)$$

and, naturally,

$$\tan\theta_K = \frac{\sin\theta_K}{\cos\theta_K} = \frac{\left[1-\cos^{2/3}\theta_1\right]^{1/2}}{\cos^{1/3}\theta_1} \qquad (3.8A)$$

If [illegible] it

$$\frac{192\,EIL}{L_0^3}\left(\left[1-\cos^{2/3}\theta_2\right]^{1/2} - \cos\theta_2\,\frac{\left[1-\cos^{2/3}\theta_2\right]^{1/2}}{\cos^{1/3}\theta_2}\right) = F_m \qquad (3.9A)$$

as the expression defining the maximum value of (F) during the "locking angle" interval. Eq. (3.9A) could be written as

$$\frac{192\,EIL}{L_0^3}\left[1-\cos^{2/3}\theta_2\right]^{1/2}\left[1-\cos^{1/3}\theta_2\right] = F_m$$

$$= \frac{192\,EIL}{L_0^3}\left[1-\cos^{2/3}\theta_1\right]^{3/2} \qquad (3.10A)$$

which is exactly consistent [illegible] Eq. (3.10A) [illegible] Eq. (3.11) of the originally-submitted "Calculation Sheet".

From the case when $L' = L$ and $\theta_1 = \theta_2 = \theta$, it is obtained [illegible] of the original "Calculation Sheet"

$$F_A = \frac{192\,EI}{L_0^3}\left(2L\left[\cos\theta - \cos\theta_2\right]\right)\left[1 - \left[\left\{f_1 + \frac{f_2 r}{2L} + f_3\right\}\frac{2}{\cos\theta} + \frac{r\sin\theta}{L} + f_3\right]\right] \qquad (3.11)$$

and also,

$$F_B = \frac{192\,EI}{L_0^3}\left(2L\left[\cos\theta - \cos\theta_2\right]\right)\frac{1}{\cos\theta}\left[1 - \left(\left\{f_1 + \frac{f_2 r}{2L} + f_3\right\}\frac{2}{\cos\theta} + \frac{\text{[illegible]}\,r\sin\theta}{2L} + \frac{\text{[illegible]}\,r\sin\theta}{L_0}\right)\right] \qquad (3.12)$$

[illegible]

[Eq. (3.13) is explained on the next page]

$$F_H = \frac{\pi EI}{L_0^2}\left(2\left[\sin\theta + \sin\theta_1\right]\right)\frac{2}{\sin\theta}\left[1-\left[\left\{f_1+\frac{f_2\pi}{2L}+f_3\right\}\frac{2}{\sin\theta}\right.\right.$$
$$\left.\left.+\frac{\pi f_2\sin\theta}{2L}+\frac{f_3\sin\theta}{2}\right]\right] \quad (3.5)$$

Above Eq. (3.5) may be reduced to

$$F_H = \frac{192EIL}{L_0^3}\left(\sin\theta-\sin\theta_1\tan\theta\right)\left[1-\left[\left\{f_1+\frac{f_2\pi}{2L}+f_3\right\}\frac{2}{\sin\theta}\right.\right.$$
$$\left.\left.+\frac{\pi f_2\sin\theta}{2L}+\frac{f_3\sin\theta}{2}\right]\right] \quad (3.6)$$

And, since

$$F = \frac{192EIL}{L_0^3}\left(\sin\theta-\sin\theta_1\tan\theta\right) \quad (3.7)$$

Then

$$\frac{F_N}{F} = 1-\left\{f_1+\frac{f_2\pi}{2L}+f_3\right\}\frac{2}{\sin\theta}+\frac{\pi f_2\sin\theta}{2L}+\frac{f_3\sin\theta}{2} \quad (3.8)$$

Now, if (F_N) is set equal to F_H, it follows that since

$$\frac{192EIL}{L_0^3}\left(1-\sin^{3/2}\theta_1\right)^{2/3} = F_H \quad (3.9)$$

Then

$$\frac{192EIL\left(1-\sin^{3/2}\theta_1\right)^{2/3}}{\left[1-\left\{f_1+\frac{f_2\pi}{2L}+f_3\right\}\frac{2}{\sin\theta_1}+\frac{\pi f_2\sin\theta_1}{2L}+\frac{f_3\sin\theta_1}{2}\right]} = F =$$

$$\frac{192EIL\left(1-\sin^{3/2}\theta_1\right)^{2/3}}{\left[1-\left\{f_1+\frac{f_2\pi}{2L}+f_3\right\}\frac{2}{\sin^{1/3}\theta_1}\left[1-\sin^{3/2}\theta_1\right]^{1/3}+\frac{\pi f_2\sin^{1/3}\theta_1}{2L\left[1-\sin^{3/2}\theta_1\right]^{1/3}}+\frac{f_3\sin^{1/3}\theta_1}{2\left[1-\sin^{3/2}\theta_1\right]^{1/3}}\right]} \quad (3.10)$$

Eq. (3.10) will therefore replace Eq. (3.1) of the originally submitted "Calculation Form".

Again, in connection with Eqs. (3F) from (3E) of the original publication, there are some errors. The following should replace the mentioned ones:-

Starting from Eq (3E) we write

$$\frac{d}{d\theta}\left[KS\sin\theta + \frac{d}{d\theta}K(\sin\theta - \sin\theta_0 \tan\theta)\right] = F \qquad (3E)$$

on carrying out the first differentiation we

$$\frac{d}{d\theta}\left[KS\sec^2\theta + \frac{d}{d\theta}K(\sin\theta - \sin\theta_0 \sec^2\theta)\right] = \frac{dF}{d\theta} \qquad (3F\text{-}A)$$

Differentially writing $\left(\frac{dF}{d\theta}\right)$ equal to zero

$$K\sin^2\theta\left[S - 2\sin\theta_0\right] = -2\cos K\sin\theta \qquad (3F\text{-}A)$$

$$\frac{2\cos\theta_0 - S}{2\cos} = \frac{\sin\theta}{\cos^2\theta} = \sec^3\theta \qquad (3F\text{-}A)$$

$$\left[\frac{2\cos\theta_0 - S}{2\cos}\right]^{1/3} = \sec\theta_1 \qquad (3F\text{-}A)$$

In order for a minimum or maximum, we subjects Eq.(3F-A) to a second differentiation, arriving at

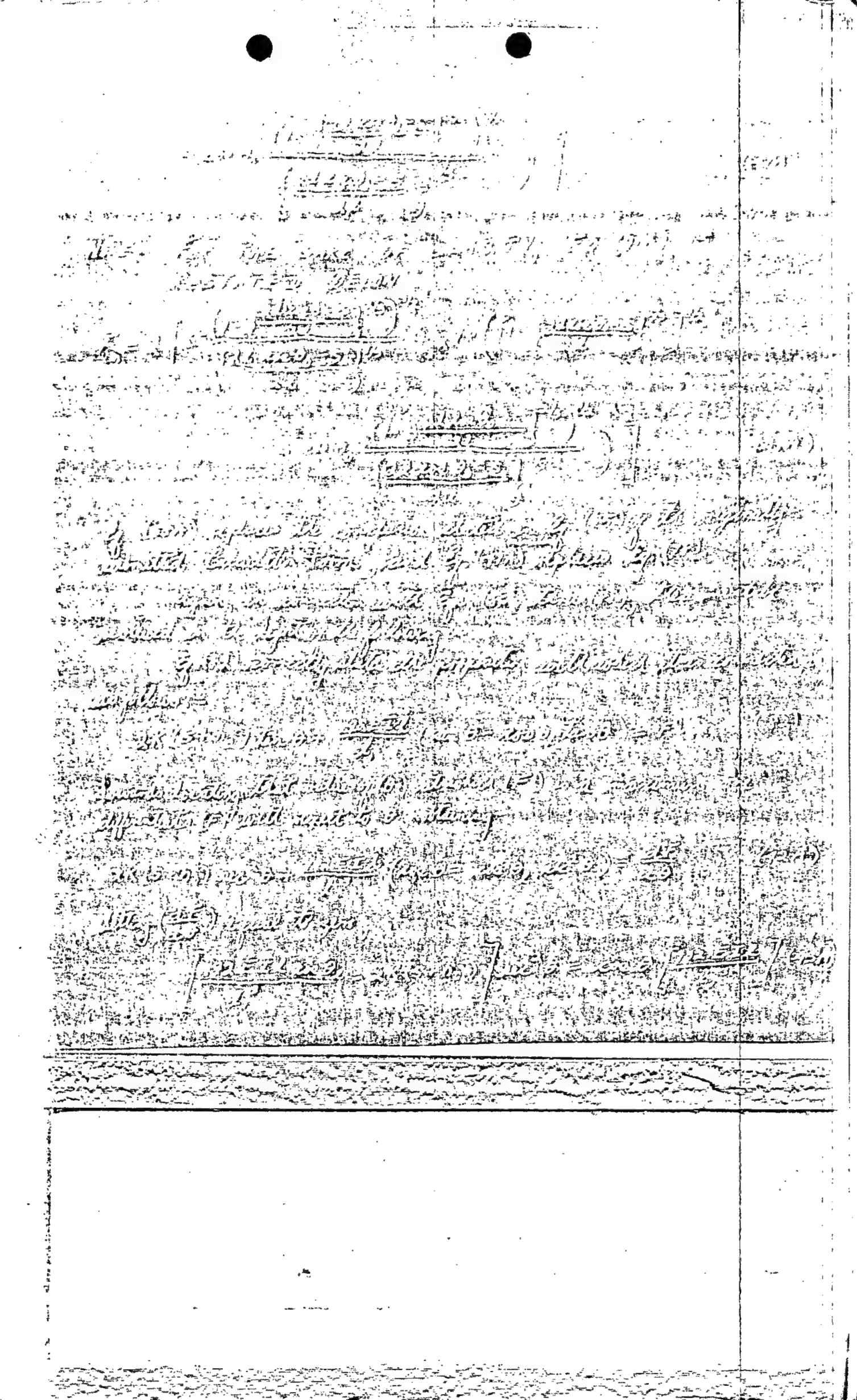
$$\frac{d}{d\theta}\left[2KS\tan\theta\sec^2\theta + \frac{d}{d\theta}K(-\sin\theta - 2\sin\theta_0\tan\theta\sec^2\theta)\right] = \frac{d^2F}{d\theta^2} \qquad (3F\text{-}A)$$

For the numerical value at which (θ_1) is taken it is clear that

$$4\cos\theta_0\tan\theta\sec^2\theta > 2S\tan\theta\sec^2\theta \qquad (3F\text{-}A)$$

and hence $\left(\frac{d^2F}{d\theta^2}\right)$ is clearly negative. And, hence, $\left[\frac{2\cos\theta_0 - S}{2\cos}\right]^{1/3}$ defines a value of (θ) at which the expression (F) is a maximum, etc. Now the following terms

$$F_m = \frac{d}{d\theta}\left[KS\frac{\left(1 - \left\{\frac{2\cos\theta_0 - S}{2\cos}\right\}^{2/3}\right)^{1/2}}{\left\{\frac{2\cos\theta_0 - S}{2\cos}\right\}^{1/3}} + \frac{d}{d\theta}K\left(\left[1 - \left\{\frac{2\cos\theta_0 - S}{2\cos}\right\}^{2/3}\right]^{1/2}\right.\right.$$



which leads to

$$\left[\tan\theta_2 - \frac{2KL_1^2(S+W_0)}{KBEIL}\right]^{1/3} = \tan\theta_K \qquad (4.44)$$

Differentiating (4.43) for a second time, and simplifying

$$+K(S+W_0)L_1\sec^2\theta + \frac{KBEIL}{L_1^2}(\tan\theta - L_1\tan\theta_2)\sec^2\theta = \frac{d^2F}{d\theta^2} \qquad (4.45)$$

Considering the numerical values of θ_2 in (4.44), it is clear that

$$\frac{KBEIL}{L_1^2}\tan\theta_2 L_1\sec^2\theta > +K(S+W_0)L_1\sec^2\theta \qquad (4.46)$$

and, hence, $\left(\frac{d^2F}{d\theta^2}\right)$ being always negative,

$$\left[\tan\theta_2 - \frac{2KL_1^2(S+W_0)}{KBEIL}\right]^{1/3}$$

where the value of (θ) satisfies (F) to be a maximum, that is, $\theta = \theta_K$

$$F_{max} = \frac{1}{2}K(S+W_0)L_1^2\frac{\left[1-\left\{\tan\theta_2 - \frac{2KL_1^2(S+W_0)}{KBEIL}\right\}^{2/3}\right]^{1/2}}{\left\{\tan\theta_2 - \frac{2KL_1^2(S+W_0)}{KBEIL}\right\}^{1/3}}$$

$$+\frac{KBEIL}{L_1}\left\{\left[1-\left\{\tan\theta_2 - \frac{2KL_1^2(S+W_0)}{KBEIL}\right\}^{2/3}\right]^{1/2}\right.$$

$$\left. - \tan\theta_2\frac{\left[1-\left\{\tan\theta_2 - \frac{2KL_1^2(S+W_0)}{KBEIL}\right\}^{2/3}\right]^{1/2}}{\left\{\tan\theta_2 - \frac{2KL_1^2(S+W_0)}{KBEIL}\right\}^{1/3}}\right\} \qquad (4.47)$$

In the above, Eq. (4.44) replaces Eq. (3.7) of the original "Calculation Form", and Eq. (4.47) similarly replaces Eq. (3.8)

With the above amendments to the original "Calculation Form", the latter is in good shape.

Very truly yours,

MLC

June 12, 1945

Dear Homer,

Enclosed you will find a combustion and temperature [illegible] of the work of the fourth, and last link of the computations governing the design of a 1st Sta-Rite 3/4" Type 250 PSI Positive Valve. All the data including complete list of Valve design in the following: the [illegible] pin design, and the strength computations for the Links themselves. The governing aspect of the Valve Design together with a drawing for the [illegible] model will go forward in the next batch. Please accept the [illegible] item for the Positive Valve in accordance with any [illegible] and the NOTE.

In the meantime, it is necessary that you give the following your immediate attention:-

It has been decided to go ahead with a multiple [illegible] proposal immediately, of which a preliminary copy of [illegible] draft is attached. The key factor in the availability of [illegible] for reaching [illegible] is manner. What you must [illegible] immediate and reliable information on is the following: (a) [illegible] pump can we get in assured quantity regularly, and at what price? (b) If possible to get the pump on the basis of a [illegible] arrangement which assures the regularity of supply and a [illegible] firm price? (c) What is the present price schedule for [illegible] multiple unit, in terms of the price per unit for each [illegible] and, (d) What is the overall market situation now?

You must not forget the fact that I ask for above [illegible] can supply them with a note in this regard by the [illegible] mail next. If the situation is at all favorable, we will go ahead immediately. Especially as regards the pump supply situation, [illegible] hand as soon as we get a favorable water supply. Until [illegible] on 70% yield of pumps from immediate pump multiple [illegible]

You can't pass the mailer test yet! But a good start!

The next test you get will contain:

a) a drawing of the 1" Pushbar "On-Off" model

b) the balance of the calculations for the above

c) the continuation of my work on perspectives and the program as a whole

d) a transistor on the Color TV pushbar prototype which I've played with here, and can't record responses for the Friend and Friend vibrations until interfaced in the analog Dino display

and

e) the article I promised you.

All of these are presently in various unfinished forms, with the exception of the drawing as noted, which requires another drawing before it can be forwarded under the present scheme of things. As they are, I have permitted the drawing to go.

Rod assured Joel they will be rapidly moving on completing any unfinished work at the time.

Robin is the Expeditions unit, Alan Jones Nancy Smith will give you to know it build incorporating Sony's modifications. Jo Ann to [illegible] when she has been used. Jeder gave Nancy some instructions on the printing of the Moving Entity. What has done about this? Next time Nancy comes, let her know the drawing with her as that I can give it a final going-over before committing to print. Let Nancy have a print of the Friend Eyll on the Operator which I gave you on the release of your last test here.

I'm working as hard as I can now to clean up the and complete them to enable them for you. As time (as) these above are assumed for the next batch. Immediately after the [illegible] of all Expeditions work will follow.

Abe

MR. HERMAN GOLDFARB
% TECHNIFLEX CORP.
PORT JERVIS, NEW YORK

The Design Of A 4" On-Off Type Packless Valve

Assume a 4" sch 80 nozzle mating to pad against 250 psig feedwater with a flow of 1% of rated output. Assume that the force $\vec{F}$ is given by the formula:-

$$\vec{F} = 0.22 (\Delta p)_m (D_N) \text{ lbf}$$

where

Δp_m = the maximum pressure differential across the sealing surface = 250 psig

D_N = the nominal diameter of the valve

and design the valve for "on-off" service as a packless valve of the poppet type.

By the formula given above, $\vec{F}$ would have a value of

$$\vec{F}_N = 0.22 (250)(4)^2 \text{ lbf}$$

$$= 880 \text{ lbf}$$

If we were to centrally establish a mechanical advantage of 4:1 to be derived via the seating angle, then by the following sketch

$$\frac{1}{\sin\theta} = 5$$

or

$$\sin\theta = 0.2$$

the seating angle would have to be approximately $\theta = 20°$. If the seating force (F_s) were to be $F_s = (880)$, it follows that the seating force (F_s) when the valve is fully-seated would have to be

$$880 \sin(0.2) = 176 \text{ lbf}$$

With a port shaft of 1" O.D. and an annular area of 70%, it follows by Eq (5) for rectangular

from Chart of (b_0) we would figure it "b_0" and (w_0) we arbitrarily make it 2, then

$$2 w_0 = \pi (0.6)(1)$$

$$w_0 = \pi (0.3) = 1.256"$$

The would mean that the last-finger would occupy

$$\frac{1.256 (2)}{\pi} 360^\circ = 288^\circ$$

of the circumference. Since

$$n_0 w_0 b_0 = 1$$

and $w_0 = 1.256$, then

$$b_1 = \frac{1}{2(1.256)} = 0.4" = b_0$$

Interpreting the graph further mentioned on Page 2 of the "Calculation Form", the corrected value of (b_0) would then become -

$$1.25 (0.4) = 0.5" = b_0 \text{ (corrected)}$$

Still we must set an arbitrary length of 6" on finger "A" and 2" when $\theta = 0^\circ$ (meaning that each link would be 3" Lg.). Then then

$$2L (\cos \theta^\circ - \cos \theta_0) = b_0$$

and here

$$2(3)(1 - \cos \theta_0) = 0.5$$

$$\cos \theta_0 = 1 - \frac{0.5}{6} = 1 - 0.0833$$

$$= 0.9167$$

indicating an angle of approximately $23^\circ - 33'$ for θ_0. Likewise with the distance of travel of finger "B" it be

$$L \cos \theta_0 = 3 (.3979)$$

$$= 1.1937"$$

as going from full-open to full-closed.

Using (Δp_0) as the maximum value of 250 psi, it follows by Eq. (a) that

$$\frac{\pi}{4}(1)^2(250) = 196\#_0 = W_0$$

By another use of Eq. (a) above, with the value of 250 psi as the "full-open" pressure, then

$$\frac{196}{3} = 65.3\#$$

would be the required force which the "B" cup in the spring chamber of the valve is to be held open. But we assume that this is combined with the above computed value of 196# we see that the valve is in the full-open position. Now to prevent the valve from opening with any opening force from the spring chamber, it would be necessary that the Reed spring exert a force of 196# on the seat of the Reed spring. Then by Eq. 60

$$K = \frac{196}{3(0.5)} = 130.7\#$$

for the Reed spring. Since the spring is under the force of 196# when in the closed position with the (1") diameter exposed, apart from the pressure that only the cup of area being exposed by the travel of the valve, then the reduced force W_0 on the additional amount of Δ_0 would be imposed on the spring-plate on account of the Reed spring. The amount would amount to

$$130.7\,(0.5) = 65.3\#$$

Adding this to the final working force of 21#, we get

$$21 + 65.3 = 276.3\#$$

as the force imposed on the spring-plate. Now, let the spring-plate have a span of 3", and let us centrally place the loading applied 3.

By Eq. (23), the deflection varies from $\theta = \theta_1$ to $\theta = 0$ minute. i.e.

$$2(3)(1 - 0.1456) = 0.0054''$$

By Eq. (17),

$$\frac{4(276.3)(3)^2}{3\pi d_1^4 (26)(10^6)} = 0.0054$$

$$d_1 = \left[\frac{4(276.3)(3)^2}{3\pi (0.0054)(26)(10^6)}\right]^{1/4} = [1.45(10^{-4})]^{1/4}$$

$$= 0.348''$$

would be the required diameter of the spring shaft. By Eq. (17), we have

$$y = \frac{Pl_0^3}{48EI} = \frac{Pl_1^3}{48} \cdot \frac{l_0^2}{EI} = \frac{Ml_0^2}{EI}$$

$$= \frac{S_s \frac{I}{c} l_1^2}{EI} = \frac{S_s l_1^2}{Ec} = \frac{2S_s l_1^2}{Ed_1} = \frac{S_s l_1^2}{6Ed_1}$$

where S_s = shear stress. Using the expression, we find that

$$\frac{6Ed_1 y}{l_0^2} = \frac{6(26)(10^6)(0.0054)}{(3)^2} = S_s$$

$$= 17500 \text{ psi}$$

would be the induced shear stress. For a spring steel, this would be about 60,000 psi. For the conditions as we have used them,

$$Kh_0 + \frac{\pi^2 EIL}{l_0^3}(\sin\theta - \sin\theta_0) = F \cos\theta/2 \quad (23)$$

The expression may be transformed as follows:

$$2Kh_0 \tan\theta + \frac{\pi^2 EIL}{l_0^3}(\sin\theta - \sin\theta_0 \tan\theta) = F \quad (60)$$

To locate the value of θ at which F is a maximum, we differentiate

(F) with respect to (θ) and, on doing so, we have

$$2Kh_0 \sec^2\theta + \frac{192EIL}{L_1^3}(\cos\theta - \cos\theta_1 \sec^2\theta) = \frac{d^2F}{d\theta^2} \quad (e)$$

and noting $\left(\frac{dF}{d\theta}\right)$ equal to zero, we find

$$\sec^2\theta\left[\frac{192EIL}{L_1^3}\cos\theta_1 - 2Kh_0\right] = \cos\theta\left[\frac{192EIL}{L_1^3}\right] \quad (d)$$

$$\left[\cos\theta_1 - \frac{2Kh_0L_1^3}{192EIL}\right] = \frac{\cos^3\theta}{\sec^2\theta} = \cos^3\theta \quad (e)$$

$$\left[\cos\theta_1 - \frac{Kh_0L_1^3}{96EIL}\right]^{1/3} = \cos\theta_2$$

Using the value of (θ) for which F denotes a minimum or maximum, but from a simple inspection of (e), by doing this, we arrive at

$$4Kh_0\cos\theta\sec^2\theta + \frac{192EIL}{L_1^3}(-\sin\theta - 3\cos\theta_1\cos\theta\sec^2\theta) = \frac{d^2F}{d\theta^2} \quad (f)$$

the value of $\cos\theta_1$ being equal to $0.99\theta_2$, it is clear that

$$\frac{384EIL}{L_1^3}\cos\theta_1 > 4Kh_0 \quad (g)$$

making it clear that $\left(\frac{d^2F}{d\theta^2}\right)$ would be negative, and hence that

$$\left[\cos\theta_1 - \frac{Kh_0L_1^3}{96EIL}\right]^{1/3} = \cos\theta_2 \quad (h)$$

denotes a value of (θ) at which (F) is at a maximum. Thus

$$F_{max} = 2Kh_0\frac{\left[1 - \left\{\cos\theta_2 - \frac{Kh_0L_1^3}{96EIL}\right\}^{2/3}\right]^{1/2}}{\left\{\cos\theta_2 - \frac{Kh_0L_1^3}{96EIL}\right\}^{1/3}} + \frac{192EIL}{L_1^3}\left(1 - \left\{\cos\theta_2 - \frac{Kh_0L_1^3}{96EIL}\right\}^{1/3}\right)$$

(The equation is continued on the next page)

$$-\cos\theta_2 \left\{\frac{\left[1-\left\{\cos\theta_2-\frac{Kb_0L_0^3}{96EIL}\right\}^{2/3}\right]^{1/2}}{\left\{\cos\theta_2-\frac{Kb_1L_1^3}{96EIL}\right\}^{1/3}}\right) \quad (2)$$

$Kb_0 = 130.7\,(0.5) = 65.3$ #

$$\left\{\cos\theta_2-\frac{Kb_0L_0^3}{96EIL}\right\} = \left[0.9976-\frac{(130.7)(0.5)(3)^3}{96(29)(10^6)(I)(3)}\right] =$$

$$\left\{0.9976-\frac{3.375(10^{-7})}{I}\right\}$$

$$I = \frac{\pi}{64}d^4 = \frac{\pi(0.374)^4}{64} = \frac{\pi(1.75)(10^{-2})}{64} = 7.18(10^{-4})$$

$$\left\{0.9976-\frac{3.375(10^{-7})}{I}\right\} = 0.9976-\frac{3.375(10^{-7})}{7.18(10^{-4})} = 0.9976-3.5(10^{-4})$$

$$= 0.997246$$

$$\left\{\cos\theta_1-\frac{Kb_0L_0^3}{96EIL}\right\}^{1/3} = 0.997246^{1/3} = 0.999282$$

$$\left\{\cos\theta_2-\frac{Kb_1L_1^3}{96EIL}\right\}^{2/3} = 0.997246^{2/3} = 0.998565$$

$$\left[1-\left\{\cos\theta_1-\frac{Kb_0L_0^3}{96EIL}\right\}^{2/3}\right]^{1/2} = \left[1.0-0.998565\right]^{1/2} = (0.001435)^{1/2} =$$

$$3.7881(10^{-2}) = 0.037881$$

$$F_{cr} = 2(6653)\frac{0.037881}{0.998565} + \frac{\pi^2EIL}{L_0^2}\left[0.037881-0.998565\frac{0.037881}{0.998565}\right]$$

$$= 4.951 + \frac{\pi^2EIL}{L_0^2}\left[0.037881-0.037854\right] =$$

$$4.951 + \frac{0.000027(\pi^2EIL)}{L_0^2}$$

$$\left[\frac{KB_0I_1}{L_1^2}\right] = \frac{(19.626\times10^{-3})(1.2)}{3^2} = 2.95\ (N^5)$$

$$F_{max} = 4.951 + 0.017017(3.25)(10^5) = \frac{1.005}{10^{-3}}(10^5) + 4.951 =$$

$$10.65 + 4.951 = 15.601\ N$$

would be the most maximum force demanded of the relay electromagnetic and armature arrangement for closing that the braking of the vehicle.

The closing force, at a maximum, which is required in holding the armature at initial $\theta = \theta_0$ to $\theta = \theta_2$ against maximum. The relationship between the closing force (F) and (θ) during the forming of the power stroke would be given by

$$2lK(\sin\theta - \sin\theta_0) = \frac{F}{2}\sin\theta \qquad (1.)$$

as a close approximation. In addition that using (θ) during the mechanical contact, but we finally transform (1.) into the more convenient form embodied below:-

$$4lK(\sin\theta - \sin\theta_0\cos\theta) = F \qquad (2.)$$

and the last is differentiate (F) with respect to θ, resulting at

$$4lK(\cos\theta - \sin\theta_0\sin^2\theta) = \frac{dF}{d\theta} \qquad (3.)$$

letting $\left(\frac{dF}{d\theta}\right)$ equal to zero, we obtain

$$\frac{\cos\theta}{\sin^2\theta} = \sin^3\theta = \sin\theta_0 \qquad (4.)$$

or

$$\sin\theta_2 = \sin^{1/3}\theta_0 \qquad (5.)$$

By inspection, we see that (θ_2) defines a maximum condition for (F). Thus

$$F_{max} = 4lK\left(\left[1-\sin^{2/3}\theta_0\right]^{1/2} - \sin\theta_0\frac{\left[1-\sin^{2/3}\theta_0\right]^{1/2}}{\sin^{1/3}\theta_0}\right) =$$

$$= 4lK\left[1-\sin^{2/3}\theta_0\right]^{3/2} \qquad (6.)$$

Substituting in the formula for (F_m) during the maximum portion of the power stroke, we obtain at

$$F_m = 4(3)(130.7)\left[1 - 0.9167^{4/3}\right]^{3/2}$$

$$= 4(3)(130.7)(0.05834)^{3/2} = 22.7\#$$

as the maximum net force required during $\theta = 0°$ and $\theta = \theta_0$.

Similarly, solving the magnitude of friction (F_1), (F_2), and (F_3) for 0.01, it will be found that when

$$\left[1 - \left\{f_1 + \frac{f_2 r}{2l} + f_3\right\}\frac{2}{\cos\theta_K} + \frac{r^2 \sin\theta_K}{2l\cos\theta_K} + \frac{f_3 r \sin\theta_K}{2\cos\theta_K}\right]$$

solves the power efficiency of the toggle linkage when (F) is at its maximum

$$\left[1 - \left\{(0.01 + \frac{0.01(0.343)}{2(2)(3)} + 0.01\right\}\frac{0.0579(2)}{0.9993} + \frac{0.343(0.01)(0.9993)}{2(2)(3)(0.0579)} + \frac{0.01(0.9993)}{2(0.0579)}\right] =$$

$$= 1 - \left[\underbrace{\{\quad\}[\quad]}_{\text{complement}} + 0.0076 + 0.1315\right] = 0.8619$$

would be the efficiency of the toggle linkage at the critical angle during the "locking angle travel"; while

$$1 - \left[\left\{0.01 + \frac{0.01(0.343)}{2(2)(3)} + 0.01\right\}\frac{0.0563}{0.9976} + \frac{0.343(0.01)(0.9976)}{2(2)(3)(0.0563)} + \frac{0.01(0.9976)}{2(0.0563}\right] =$$

$$= 1 - \left[\underbrace{\{\quad\}[\quad]}_{\text{complement}} + 0.0052 + 0.089\right] = 0.9058$$

would be the toggle efficiency at the critical angle between θ_0 and θ_1. Consequently

$$\frac{45.6}{0.8619} = 53.1\#$$

would have to be found "B"s from at the critical angle between $\theta = \theta_1$ a

wound is $\theta = 0°$, while

$$\frac{230.7}{0.9855} = 233.05 \text{ lb}$$

would be the required force by finding "θ" at the critical angle between $\theta = \theta_0$ and $\theta = \theta_2$.

Solution is the spring index. By Eq. 56, if we take $D_2 = 0.5"$, $n = 4$, and (6) is taken at $12(10^6)$, it will be found that

$$\frac{d_3^4 (12)(10^6)}{8(0.5)^3 4} = 230.7$$

or

$$d_3 = \left[\frac{230.7(8)(0.125)(4)}{12(10^6)}\right]^{1/4} = \left[7.36(10^{-5})\right]^{1/4} = \frac{0.0515}{0.0515}$$

would be the required wire diameter for the coils. Now, if 116 lb is the load on the spring when $\theta = \theta_2$, then

$$116 + 0.5(230.7) = 231.35 \text{ lb} = P_2$$

would be the load on the spring when $\theta = 0°$. Hence

$$C = \frac{D_2}{d_3} = \frac{0.5}{0.051} = 6.18$$

Also

$$k = \frac{4C-1}{4C-4} + \frac{0.615}{C} = \frac{4(6.18)-1}{4(6.18)-4} + \frac{0.615}{6.18} = 0.944 + 0.095 =$$

$$1.039$$

and by Eq. (55)

$$\frac{8(116.4)(0.5)(1.039)}{\pi\, 0.0915^3} = 770{,}000 \text{ lb/in}^2 = S_2$$

would be the stress in the spring. This is for the high, and would be the maximum of the spring.

Since the stress is a tolerable amount, no further increase in the wire diameter is

$$\frac{970,710}{300,000} = \left[\frac{d}{0.0713}\right]^3$$

$$\left[\frac{7.7}{2}\right]^{1/3} 0.0513 = 0.1278''$$

To maintain the desired K-value for the spring, it would be necessary to increase the mean-coil diameter.

$$\frac{0.1278^4 (12)(10^6)}{8(0.5)^3\, n} = 1307$$

$$n = \frac{0.1278^4 (12)(10^6)}{8(0.5)^3 1307} = \frac{2.67(10^{-4})(12)(10^6)}{8(0.25)(10^{-1})(0.507)(10^6)} = 24.5 \text{ turns}$$

which would again make for a rubbing condition. If however, the mean coil diameter (D_m) is $0.75''$, then

$$\left[\frac{0.75}{0.5}\right]^{1/3}(0.1278) = \frac{0.145}{0.1278}$$

which would be required to maintain the recommended clash limit, while

$$\frac{8(0.75)^3(1307)}{8(0.75)^3(1307)} = n = \frac{12}{8(0.75)^3(1307)} = \frac{12.6}{8(0.75)(1307)} = 12.6 \text{ turns}$$

would be required to obtain required K-value for the spring. You should now work out the proper direction of winding of the spring (the formula are incorrect) for D_m, with the appropriate multiplication of (d_w) and (n) to obtain the desired K-value and (n). Q.1" Determine the weight

$$\left[\frac{1}{0.5}\right]^{1/3} 0.1278 = 0.1611''$$

Now, since

$$\left[\frac{0.1611}{0.1278}\right]^4 \left[\frac{0.5}{10}\right]^3 24.5 = 7.5 \text{ lbs.}$$

of this order. Thus $\omega = f''(D_m)$, & thus from, $0.162''$ (the wire gage) the spring would suffice.

Mr. S. North
Sloan House
34th St.
New York City

HOLD FOR:-

MR. J. E. TARTAKOW

PERSONAL

June 12, 1951

Dear Mrs. A. Jackson
Ward for J

Dear Mary,

Just a note to let you know that I am sending my book
to Mary, and that I expect to have it go forward by early next month
complete form.

As to that other matter I spoke to you about, the name title
that will contain the story will also contain the name of the author I
want.

Long as I have to wait longer, but you'll have it before 1952
at least I can do under the circumstances. If I can work it out, I'll
let you know as soon as possible. If I can't work it out,
then someone could give at your visit to work or write to give
you a further explanation.

As will you hear from me again, C, C, & P, and best wishes
P for patience.

Yours,
Mc

P.S It may be with you a few days of explain. Please let me know
how you like it

A

FD-141
(1-13-48)

BULKY EXHIBIT

Date received 6/20/51

ABRAHAM BROTHMAN, was

100-95068-1B

(Title of case)

Submitted by Special Agent JOHN M. COLLINS

Source from which obtained Warden E.F. Thompson

Address Federal Detention Headquarters, NYC

Purpose for which acquired Investigation

Location of bulky exhibit In cabinet with file

Ultimate disposition to be made of exhibit Retained

Estimated date of disposition - To be decided at conclusion of case

List of contents:

118. Photostatic copy of letter dated 6/18/51 addressed to "Dear Herman".
119. Photostatic copy of 14 page treatise entitled "SHIFTING FROM A DYNAMIC VIEWPOINT".
120. Photostatic copy of letter dated 6/18/51 from Brothman to S. Lidz os Starrett Television Corp.

70

100-95068-1B

Mr. Herman Goldfarb
% Trennfler Corp
Port Jervis, New York

June 18, 1951

Dear Harry,

What's enclosed will be quite a comedown from what was promised to you in my last letter. But when you see the enclosed letter to Sidney Fitz, you'll understand as it happened without further explanation.

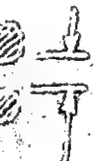
Next time you're in New York, ask Fitz to give you a copy of the paper that the letter mentions. Actually the contents of an extract from the article which I discussed with you, and that we plan for publication in the near future. Like it, anyhow!

I hope that you've made good progress on the things I asked of you in my last letter. I'm looking forward to word from you on these regards. Make it as soon as possible. Enclosed you will also find the last pages of the computations on a 10" On-Off Bubble Valve. You will complete the computations on these. The drawings will follow for work in the next mail. I've just got to check them.

I'm also trying to make arrangements for a special meeting with you here. I'll have word to you on this in the near future.

Please comply with all of the requests in my last letter.

Yours,
Abe



[illegible] bearing pressure, the width of the [illegible] "B" must be [illegible]

$$\frac{2.5}{2(1.0)(0.25)} = 10.46$$

In looking at the section from below the cross slot and the maximum [illegible] bearing pressure. The load should be that of the number of 5.0 giving a [illegible] width of approximately 1.0.

We cannot now set the design of the first column therefore [illegible] using Equation (90), and assuming the use of a 1" [illegible] the [illegible]

$$P_2 = 276.3 = S_c\left[0.785\,(0.25)^2\right] / \left(1 + \frac{4}{25m}\left(\frac{L_c}{r}\right)^2\right)$$

$$\frac{276.3\left[1 + \frac{4(0.06)}{25(0.25)}\right]}{0.785\,(0.0625)} =$$

$$\frac{276.3\,[1 + 0.072]}{0.785\,(0.0625)} = 6050\ \#/in^2$$

[illegible] the compressive stress indicated in [illegible] "A" and "C", and [illegible] is [illegible] acceptable value. If the same number [illegible] for [illegible] "B", it [illegible] without saying that the compressive stress indicated would be even more acceptable.

We now [illegible] the number of 10d shingle nails in [illegible] (which we have already found to be adequate), the design of the [illegible] which support the shingles. Assuming a compressive bearing [illegible] (which is now 300 #/in^2) as indicated above by Eq. (96) at a bearing length of [illegible]

$$\frac{276.3}{2(L_c)(0.375)} = 1000$$

$$L_c = \frac{276.3}{1000(2)(0.375)} = 0.375"$$

say 7/16".

SHAFTING FROM A DYNAMIC VIEWPOINT

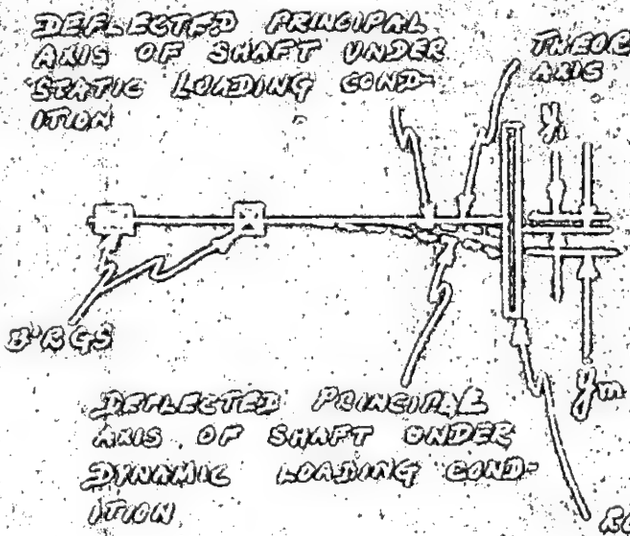


FIG. I

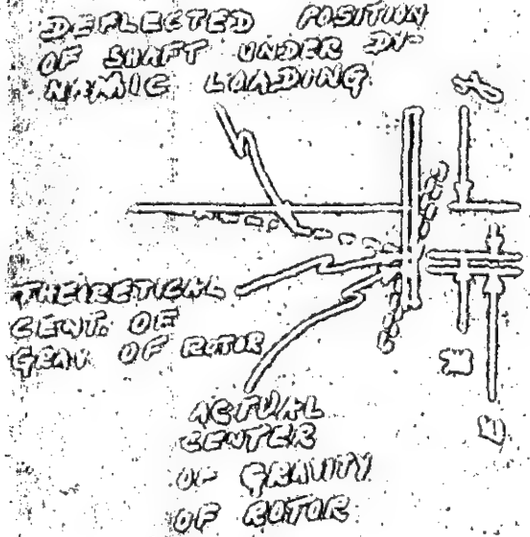


FIG. II

In Fig. I, there is shown a condition where the shaft has a rotor attached, of weight (W) and eccentricity (E). By an eccentricity (E), it is meant that the true (or actual) centre of gravity of the rotor lies a distance of (E) inches from the theoretical axis of rotation of the rotor, which coincides with the centre line of the shaft on which the rotor is mounted. It is assumed that the shaft supporting the rotor (W) would, under static conditions, assume a deflection equal to y_s (say). Under dynamic conditions, it is assumed that a relation between the static deflection of the shaft and the centrifugal force, due to the weight of the rotor, would exist to give maximum deflection, which would be given by

(y_m), as shown. In Fig. II, it is seen that, in establishing the radius at which the centrifugal displacement force (F_c), it would have to be taken as the sum of (y), any given displacement from the theoretical axis of inertia, and E; and, thus (F_c) would be given by

$$F_c = \frac{W}{g}(y + E)\,\omega^2 \qquad (1)$$

where :- ω = the angular velocity of the assembly in radians per sec; and, g = the gravitational acceleration constant in consistent units.

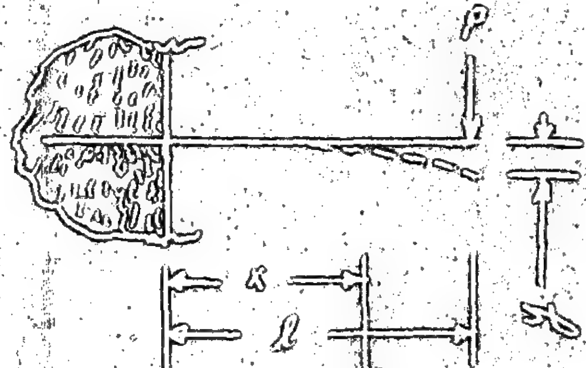


Fig. III

In the cantilever beam shown in Fig. III, it is clear that the bending moment where $x=0$ would be at a maximum, and would decrease from there to where $x=l$ according to

$$M = P(l - x) \qquad (2)$$

and, accordingly

$$E_T I \frac{d^2y}{dx^2} = -P(l - x) \qquad (3)$$

where

(E_T) = Young's modulus of elasticity in tension-compression

I = moment of inertia of the beam

Subjecting Eq. (3) to the successive steps of integration, we find :-

$$E_T I \frac{dy}{dx} = -P\left(lx - \frac{x^2}{2}\right) + C_1 \qquad (4)$$

But $\left(\frac{dy}{dx}\right)$, the slope of the elastic curve, is clearly zero when $x=0$; and, thus (C_1), the constant of integration must be zero. Then, (4) reduces to

$$E_T I \frac{dy}{dx} = -P\left(lx - \frac{x^2}{2}\right) \qquad (5)$$

which when integrated again, yields

$$E_T I \cdot y = -P\left(\frac{lx^2}{2} - \frac{x^3}{6}\right) + C_2 \qquad (6)$$

Again, it is clear that when $x=0$, (y) would also equal zero; and, hence, the constant of integration, (C_2), would have to equal zero, leaving Eq. (6) in the form

$$-y = \frac{P}{E_T I}\left(\frac{lx^2}{2} - \frac{x^3}{6}\right) \qquad (7)$$

Setting $x = l$, Eq. (7) takes the form

$$y = \frac{P l^3}{3EI} \tag{I}$$

Which rearranged in the form

$$\frac{3EI}{l^3} = -\frac{P}{y} = K \tag{II}$$

we find that Eq. (I) leads to a definition of the constant of elastic recovery, or the "spring-constant" (K) of the beam in question. Considering the shaft-member of the device in Figs. (II) and (III) as the beam which it really constitutes, it follows that we can write for the elastic recovering force of the shaft its

$$F_E = Ky \tag{IV}$$

when the shaft is displaced a distance (y) from its theoretical position. Now the taking-up of any given position of displacement involves an instantaneous equilibrium between (F_E) and (F_I); hence it is clear that we may write:-

$$Ky = \frac{W}{g}(y + E)\omega^2 \tag{V}$$

Departing for a moment, (V) we return to Fig. I. The theoretically deflected shaft-member shown in Fig. I would be expected, in consequence of the balance of forces implied in Eq. (V) and in consequence of its elastic nature, to act as a spring — a spring undergoing a simple harmonic oscillatory motion. If such were the case, (y) would be expected to vary as a function of Time. Explicitly, where t = Time, and ω_n = the number of oscillations (natural oscillations) for 2π seconds, the instantaneous value of (y) would be given by:-

$$y = y_m \cos \omega_n t \tag{VI}$$

where (y_m) is the displacement position corresponding to $t = 0$. If we further premise that the velocity of the shaft-member as you notice $y = y_m$, it would follow that

$$\frac{dy}{dt} = -\omega_n y_m \sin \omega_n t \tag{VII}$$

Since Eq.(63) describes the instantaneous velocity of the vibrating shaft about its oscillating transverse position (y), it follows that the kinetic energy (E_K) of the rotor at any point along its length would be given by:-

$$E_K = \frac{W}{2g}\left(\frac{dy}{dt}\right)^2 = \frac{W}{2g}\left(\omega_n^2 y_m^2 \sin^2 \omega_n t\right) \quad (64)$$

Referring to Eq.(60), the strain (potential) energy stored up in the shaft at any displacement (y) from its transverse axis would be given by

$$E_P = \int_{y=0}^{y=y} F_E \, dy = K \int_{y=0}^{y=y} y \, dy = \frac{K}{2} y^2 \quad (65)$$

where (E_P) = the potential (or restorative) energy stored up in the shaft.

Obviously, the total energy of the vibrating system shown in Fig. 1 would be composed of the kinetic energy of the rotor-and-shaft system and the potential (or restorative) energy stored up in the shaft. The principle of the conservation of energy would demand that, neglecting damping, the function,

$$E_P + E_K = \text{constant} = k \quad (66)$$

at all times. This being so, it is interesting observe the conditions which hold when $y=0$ and when $y=y_m$.

When $y=0$,

$$E_P = 0 \quad (67)$$

since this would follow by definition from Eq.(65). However, since

$$\sin \omega_n t = 1 \quad (68)$$

the maximum value between 0 and π radians, it follows inevitably that (E_K) would have its maximum value when $y=0$; and this maximum value would be given by:-

$$[E_K]_{max} = \omega_n^2 y_m^2 \frac{W}{2g} \quad (69)$$

Summing up these for the maximum amplitude y_m, it is seen that

$$E_P + E_K = A = 0 + [E_K]_{max} \tag{20}$$

or

$$[E_K]_{max} = A \tag{21}$$

When $y = y_m$, it follows by definition from Eq. (15) that (E_P) assumes within its maximum value; and we shall be given by:-

$$[E_P]_{max} = \frac{K}{2} y_m^2 \tag{22}$$

With the same order of (y),

$$\sin \omega t = 0 \tag{23}$$

and, hence,

$$E_K = 0 \tag{24}$$

Summing up this, for $y = y_m$,

$$E_P + E_K = A = [E_P]_{max} + 0 \tag{25}$$

or

$$[E_P]_{max} = A$$

By Equations (19), (20), (21), (22) and (23), it follows that

$$\frac{W}{2g} \omega_N^2 y_m^2 = \frac{K}{2} y_m^2 \tag{26}$$

and, further,

$$\omega_N = \left[\frac{Kg}{W}\right]^{1/2} \tag{27}$$

Referring to Eq. (11), it is found, with help of (27), that assuming (11) in the form

$$\frac{Kg}{W} = \frac{(y + E)\omega^2}{y} = \omega_N^2 \tag{28}$$

$$= \left(1 + \frac{E}{y}\right)\omega^2 = \omega_N^2$$

and, by further arrangement, we find that

$$\frac{\omega_N^2}{\omega^2} = 1 + \frac{E}{y} \tag{29}$$

and

$$y = \frac{E}{\frac{\omega_N^2}{\omega^2} - 1} \tag{30}$$

The significance to be attached to Eq. (30) are many. Firstly, it indicates that when the angular velocity of the assembly is equal to the assembly's natural frequency of vibration, (and, when, therefore, the denominator of [30] reduces to zero), the deflection (y) will become infinite (i.e. the shaft will shear) regardless of how small the unbalanced weight or eccentricity of the rotor is. Thus a resonance between the natural frequency of vibration of the system and the angular velocity of the shaft assembly must be avoided at all costs. Avoiding the undesired resonance condition entails doing one of four things:-

a) (ω_N) may be established at a value substantially greater than (ω), which is the conventional thing to do;

or

b) (ω_N) may be established at a value substantially smaller than (ω).

When

$$\omega > \omega_N \tag{31}$$

the deflection of (y) as a positive magnitude given Eq. (30) has the following form:-

$$y = \frac{E}{1 - \frac{\omega_N^2}{\omega^2}} \tag{32}$$

From Eq. (32), it follows that the more that (ω) exceeds (ω_N), the smaller does (y) become. This is to say that when (ω_N) is established well beneath (ω) (or "far" (ω) exceeds the assumed speed"), the physical deflection is such that the shaft will exert a self-straightening action on itself. This self-straightening action is such that the

and $\left(\frac{\omega_N}{\omega}\right)^2$ approaches zero as the limit, since ratio in (y) and hence (E) as an asymptotic limit.

In formula Eq. (30), which holds for the condition where

$$\omega < \omega_N \tag{33}$$

and a shaft diameter which is stressed to a given limit, is found as follows:-

Since (y) is also defined by:-

$$\frac{Pl^3}{EI} = y \tag{7}$$

we may write

$$\frac{Pl^3}{3E_1 I} = \frac{E}{\frac{\omega_N}{\omega} - 1}$$

$$= \frac{(Pl)\,l^2}{3E_1 I} \tag{34}$$

But

$$Pl = M \tag{35}$$

(another) for a shaft which is loaded at its end, as Note Eq. (34) now takes the form

$$\frac{E}{\frac{\omega_N}{\omega^2} - 1} = \frac{Ml^2}{3E_1 I} \tag{36}$$

But, for all beams, the moment (M) is also defined by:-

$$M = ZS \tag{37}$$

where:- S = the allowable stress in the shaft, and Z = the sectional modulus of the beam in question. Thus, Eq (36) now goes to the form

$$\frac{E}{\frac{\omega_N}{\omega^2} - 1} = \frac{ZSl^2}{3E_1 I} \tag{38}$$

Since it is also true that, for a round section,

$$\sigma = \frac{T}{c} \tag{39}$$

where c = the distance of the farthest surface from the neutral plane, as further follows from:

$$\frac{E}{\frac{\omega_N^2}{\omega^2} - 1} = \frac{\frac{I}{c} S l^2}{3 E_T I} = \frac{S l^2}{3 E_T c} \tag{40}$$

and, hence, since

$$c = \frac{d}{2} \tag{41}$$

for a round section of diameter (d), then

$$\frac{E}{\frac{\omega_N^2}{\omega^2} - 1} = \frac{2 S l^2}{3 E_T d} \tag{42}$$

By (37), however,

$$\omega_N^2 = \frac{K g}{W} \tag{43}$$

and by (9)

$$K = \frac{3 E_T I}{l^3} \tag{9}$$

we have

$$\frac{E}{\left[\frac{3 E_T I g}{l^3 W}\right] - 1} = \frac{2 S l^2}{3 E_T d} \tag{44}$$

Eq. (44) may finally be written in the form

$$E = \frac{2 S l^2}{3 E_T d} \left[\frac{3 E_T I g}{l^3 W \omega^2} - 1\right] \tag{45}$$

And, lastly, for a round section,

$$I = \frac{\pi d^4}{64} \tag{46}$$

$$\frac{\pi S_q d^4}{32 L W_w^2} - E d - \frac{2 S L^2}{3 E_T} = 0 \qquad (47)$$

It follows that the solution of the quantic set forth by (47), for a prescribed limit for (S), a practical limit for (E), and the appropriate value of (E_T), would yield a shaft diameter (d) which satisfies the condition that

$$w \leq w_N$$

By inspection, we may now write that when it is intended that

$$w > w_N$$

the quantic to be solved would be:-

$$\frac{\pi S_q d^4}{32 L W_w^2} - \frac{2 S L^2}{3 E_T} + E d = 0 \qquad (47a)$$

NOTE:- To preserve the symmetry of the form of (47), Eq (47a) should be written

$$\frac{\pi S_q d^4}{32 L W_w^2} + E d - \frac{2 S L^2}{3 E_T} = 0 \qquad (47b)$$

Whether the condition

$$(w) < (w_N),$$

or the condition

$$(w) > (w_N)$$

should be established should be resolved by

a. the required diameter of the shaft in Eq (47)

and,

b. the magnitude of the combined bending and torsional stresses induced in the shaft.

and,

c. the body of practical information which can be found.

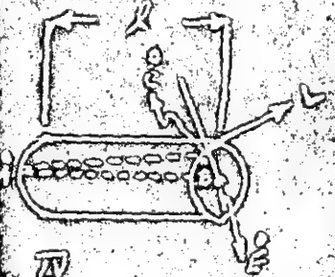


Fig. IV

Consider the round bar shown in Fig. IV, fixed at the end and twisted at the free end, such that the bar is being twisted by a tangentially applied force (F_t). Assume that the bar is twisted uniformly for a distance L, and that the angle through which the radius OB at the free end is twisted is θ radians. Consider a small element EF, of the length δx, of the bar, and let the radius OE, in a position of the twist, be displaced through an angle $\delta\theta$ relative to the fixed radius OF. Then, from the definition of shear strain, the shear strain in the material at a radius r is given by:-

$$\frac{r\,\delta\theta}{\delta x} = \gamma \qquad (49)$$

where:- γ = the shear strain induced in the material at a radius r.

Now, from the definition of shear stress, the shear stress induced in the material at a radius r is given by:-

$$\tau = G\gamma \qquad (50)$$

where:- τ = the shear stress induced in the material at a radius r.

Substituting for γ from (49) in (50), we have:-

$$\tau = G\frac{r\,\delta\theta}{\delta x} \qquad (51)$$

Now, the shear stress τ at a radius r produces a shear force δF_s on an elemental area δA at this radius, such that:-

$$\delta F_s = \tau\,\delta A \qquad (52)$$

Substituting for τ from (51) in (52), we have:-

$$\delta F_s = G\frac{r\,\delta\theta}{\delta x}\,\delta A \qquad (53)$$

The moment of this force about the centre of the bar is $r\,\delta F_s$, and the total moment of resistance (M_t) is the sum of all such moments for the whole cross-section of the bar, i.e.:-

$$M_t = \sum r\,\delta F_s = \sum G\frac{r^2\,\delta\theta}{\delta x}\,\delta A \qquad (54)$$

But, G, $\delta\theta$, and δx are constant for the whole cross-section, so that:-

$$M_t = G\frac{\delta\theta}{\delta x}\sum r^2\,\delta A \qquad (55)$$

But, $\sum r^2\,\delta A = I_p$, the polar moment of inertia of the bar, so that:-

$$M_t = G\frac{\delta\theta}{\delta x}I_p \qquad (56)$$

Now, $\frac{\delta\theta}{\delta x}$ is the angle of twist per unit length, and if the total angle of twist, θ, is over a length L, then:-

$$\frac{\delta\theta}{\delta x} = \frac{\theta}{L} \qquad (57)$$

Substituting for $\frac{\delta\theta}{\delta x}$ from (57) in (56), we have:-

$$M_t = G\frac{\theta}{L}I_p \qquad (58)$$

Rearranging (58), we have:-

$$\frac{M_t}{I_p} = G\frac{\theta}{L} \qquad (59)$$

Now, $M_t = F_t \times d$, where d = the diameter of the bar, so that:-

$$\frac{F_t \times d}{I_p} = G\frac{\theta}{L} \qquad (60)$$

Now, $I_p = \frac{\pi d^4}{32}$, so that:-

$$\frac{F_t \times d}{\frac{\pi d^4}{32}} = G\frac{\theta}{L} \qquad (61)$$

Rearranging (61), we have:-

$$\frac{F_t \times d}{\frac{\pi d^4}{32}} = \frac{\tau}{\frac{d}{2}} \qquad (62)$$

Now, $\frac{\theta}{L} = \frac{\tau}{G}$, so that:-

$$\frac{F_t \times d}{\frac{\pi d^4}{32}} = \frac{\tau}{\frac{d}{2}} = G\frac{\theta}{L} \qquad (63)$$

Now, $F_t \times d = M_t$, so that:-

$$\frac{M_t}{\frac{\pi d^4}{32}} = \frac{\tau}{\frac{d}{2}} = G\frac{\theta}{L} \qquad (64)$$

Now, $\frac{\pi d^4}{32} = I_p$, so that:-

$$\frac{M_t}{I_p} = \frac{\tau}{\frac{d}{2}} = G\frac{\theta}{L} \qquad (65)$$

Now, $\frac{d}{2} = r$, so that:-

$$\frac{M_t}{I_p} = \frac{\tau}{r} = G\frac{\theta}{L} \qquad (66)$$

Also,

$$I_p = \frac{\pi d^4}{32} \tag{57}$$

for a round bar, Eqn (54) may also be written

$$\frac{32 M_t}{\pi d^3 G} = \frac{\theta}{L} \tag{54}$$

$\left(\frac{\theta}{L}\right)$ above which may be called torsional stiffness. Conventionally, 2.4 Deg is accepted for a stiffness of 1^0 of twist per twenty diameter of length. And a condition would be satisfied by:-

$$\frac{32 M_t}{\pi d^4 G} = \frac{2\pi}{360} / 20 d = \frac{2\pi}{360(20)d} \tag{55}$$

Making it

$$\left[\frac{32(360)(20) M_t}{2\pi^2 G}\right]^{1/3} = d \tag{56}$$

$$= 28.7 \left[\frac{M_t}{G}\right]^{1/3}$$

Eq. (56) therefore provides a formula for computing the diameter of shafting which complies with conventional standards for torsional stiffness. Returning to Eq. 49, it will be seen that it is possible, in view of (57), to write:-

$$\frac{32 M_t d}{2\pi d^4} = \frac{16 M_t}{\pi d^3} = S_s \tag{58}$$

thus giving us an expression for intensity (S_s).

Obviously, where S = the shear stress induced in Bending, and S_s = the shear stress induced in Torsion, the combined stress (S_c) also its limit, would be given by:-

$$\left[S^2 + S_s^2\right]^{1/2} = S_c \tag{59}$$

Therefore we are then brought to the limit of the section affecting the design of the shaft in question, namely the width of torsional fillets.

In a simple angle disc system as is indicated in Fig. 1, the torsional elasticity of the system would supply the elasticity of a simple harmonic motion and if we had by the use, we would expect that the instantaneous value of (θ), the angular displacement of the system, would be given by :-

$$\theta = \theta_m \sin[\omega_n]_T t \qquad (60)$$

where $= (\theta_m)$ = maximum angular displacement of the system, and also the displacement at $t = 0$; $(\omega_n)_T$ = the number of natural angular time per 2π secs ; and (t) = time. If we further assume that the velocity of the system in torsional oscillation is zero when $\theta = \theta_m$, it would follow that :-

$$\frac{d\theta}{dt} = [\omega_n]_T \theta_m \cos[\omega_n]_T t \qquad (61)$$

would denote the angular velocity of the system in passing through any and all points in its oscillatory path.

And the energy of a rotating body is given by :-

$$E_K = \tfrac{1}{2}\Sigma(mr^2)\omega^2 \qquad (62)$$

where :- $\Sigma(mr^2)$ = the inertia of the rotating body about its axis of rotation ; and ω = the angular velocity of the body in rotation, then

$$E_K = \tfrac{1}{2}\Sigma(mr^2)[\omega_n]_T^2 \theta_m^2 \cos^2(\omega_n)_T t \qquad (63)$$

The shaft in its capacity as a torsion-spring exerts the angular oscillating motion of the disc and in the course, exerts its stress-up the kinetic energy of the oscillating disc in the form of potential energy (E_P). Combining Eqs. (49) and (53), we arrive at :-

$$\frac{Ld}{I_p G} = \frac{\theta}{L} = \frac{Ld}{2I_p G} \qquad (64)$$

which, when rearranged, are as follows :-

$$\frac{2I_p G}{Ld} = \frac{T}{\theta} = K_T \qquad (65)$$

Define the "spring-constant" for the shaft as a torsion spring. Then it follows that restoring force (F_R) of the spring would be

$$F_R = \frac{d}{dl}\left(\frac{I_p G}{l}\theta\right) = K_T \theta \qquad (66)$$

and the potential energy stored as a result of (θ) radians rotation would therefore be given by:-

$$E_p = \frac{2 I_p G}{l d}\int_{\theta=0}^{\theta=\theta} d(d\theta) = \frac{I_p G}{2l}\theta^2 \qquad (67)$$

NOTE:- In (67), the quantity $d(d\theta)$ is the moment of area with dimensions of the product $[d\theta]$, in which $[d]$ stands for the dimension of the shaft and (θ) stands for the angular twist of the torsion spring. The factor $(\frac{1}{2})$ within the $\int$ sign corrects the product $(d\theta)$ to a circumferential distance for a shaft of (d) diameter.

As per the logic in the case of the previously-considered lateral vibration of the shaft, (E_K) has its maximum value when $\theta = 0$, and is expressed by

$$[E_K]_{MAX} = [\omega_N]_T^2\, \theta_M^2 \left\{\frac{1}{2}\Sigma(m r^2)\right\} \qquad (68)$$

and $[E_P]$ expresses its maximum value when $\theta = \theta_M$, and is expressed by:-

$$[E_P]_{MAX} = \frac{I_p G}{2l}\theta_M^2 \qquad (69)$$

Again, by analogy to the case of the previously-considered lateral vibrations,

$$[E_P]_{MAX} = [E_K]_{MAX} \;\therefore\; \frac{I_p G}{2l}\theta_M^2 = \frac{1}{2}\Sigma(m r^2)[\omega_N]_T^2\,\theta_M^2 \qquad (70)$$

from which it would follow that:-

$$\left[\frac{I_p G}{l\,\Sigma(m r^2)}\right]^{1/2} = [\omega_N]_T \qquad (71)$$

Since a simple check, where

$$\Sigma(mr^2) = \frac{WD^2}{4g} \qquad (72)$$

$(\omega_N)_T$ would be given by:-

$$\left[\frac{8 I_p G_s}{WD^2 L}\right]^{1/2} = [\omega_N]_T \qquad (73)$$

Additionally, since

$$I_p = \frac{\pi d^4}{32} \qquad (74)$$

Eqn. (73) may be written

$$\left[\frac{\pi d^4 G_s}{4 WD^2 L}\right]^{1/2} = [\omega_N]_T \qquad (75)$$

Note:- In Eqns. (72) thru (75), D = the diameter of the outer disc.

Eq. (75) provides the basis by which the shafting should be considered.

June 16, 1951

Enclosed you will please find a "Standard" Instrument "Lifting Arm for a Pneumatic Viewpoint", a complete lifting unit for a very popular viewpoint.

Actually, the document we have put with the design of our Thrust shafts, and the work, I thought, would be of interest to you (from an application point of view) in your proposed design of a CBS-type radar which you mentioned, when I met you in Paris, that you would like it would a four-bearing support arrangement as per below.

in favor of the type of arrangement shown on Page 1 of the enclosed drawing, I promised you that I would provide you with the auxiliary-thrust expression to enable a radially-shaped auxiliary arrangement.

From a practical point of view, the most convenient form of the expression can be summarized down to Eqs. (57), (58), (59), (60), (61), and (62). The derivation of the shaft is of great value, and appreciate with you've got it for when you're derived of textbooks.

Now, for the above-mentioned Equations:-

Eq. (57) applies to a turbine shaft which is operated at the angular velocity which is less than the frequency of the free or natural vibration (lateral vibration) of the shaft. Eq. (58) applies to a turbine shaft which is operated at an angular velocity which is greater than the frequency of the free lateral vibration of the shaft. In both cases, the given data must consist of:- (S), the shaft axial loading; (g), the gravity acceleration constant; (W), the weight of the rotor; (ω), the angular velocity of the shaft; (E), the modulus of the rotor; (L), the unsupported or free shaft length of the shaft; and, (E_T) the Young's Modulus (or the modulus of elasticity in tension-compression) of the shaft material. And, in addition, (d), the required diameter of shaft, would be the unknown

for which one solves.

(S) should be taken at about 15,000 psi in Eq. (47) and as low as 10,000 psi in Eq. (48), if ordinary commercial shafting is used.* (g) should be taken in units of inches per second squared; (W), in lbs.; (ω), in radians per second; (l), in inches; and (E_T), for carbon steel shafting, would run about 30(10^6) psi. (E), which is the departure of the true center of gravity from the theoretical axis of inertia (in inches), is a matter of estimate, depending on the care with which the rotor is balanced. It would probably be a conservative thing, for a rotor of roughly 36", to take (E) at 1/8".

Briefly, the condition on which Eq. (47) is based is one in which the closer that the angular velocity of the shaft approaches its frequency of free natural lateral vibration, the greater would the "dynamic deflection" of the shaft be. Stiffness under operating conditions for the generic class of operation proposed by Eq. (47) would demand an increasing order of shafting diameter to meet the demand of decreasing orders of "dynamic deflection". On the contrary, the condition on which Eq. 48 is based is one in which the more that the angular velocity of the shaft exceeds its frequency of free natural lateral vibration, the less would the "dynamic deflection" of the shaft be. In other words, Eq. (48) is based on the "self-straightening" action which is characteristic of shafting operated beyond its "resonance" or "critical" speed.

For many reasons, Eq. (48) proposes a preferred condition; and, as we shall see later, these reasons go beyond "getting away" with a smaller diameter of shafting. But, as the comments at the bottom of page 9 indicate, whether or not a (d) value obtained via Eq. (48) can be used depends on other factors.

Using the maximum torsion to which the shaft is subjected (and this might be the start-up torque), the value for (d) obtained via Eq. (48)

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* In Eq. (48), decreased values for (S) will result in reduced values for (d), the diameter of shafting required. (S) may even be taken as low as 5,000 psi with caution.

should be checked via Eq. (5.6) for its suitability. The condition for limiting stress in mild steel is satisfied. Now is the first limit, and next the second important criterion.

Firstly, the value yielded by Eq. (5.8) should be limited in such a way that the slenderness ratio which is applicable under the maximum force, i.e. value for (S_c), the slenderness ratio arising out of the limiting load, should not be exceeded in Eq. (5.7), along with the design-compressive stress (σ_c) in (5.8), — all as per Eq. (5.7) — to obtain the combined stress arising out of bending and thrust. If the combined stress (S_c) thus worked out is 80% - 85% of the elastic limit for the shifting material, it can be accepted.

In Eq. (5.6), (q) may be taken for modern steel as in (III C), i.e. in Eqs. (5.6) and (5.7), (d) is of same as index. (S_c) in (5.8) is in units of psi. In Equation (5.7), the units for all stress combined are psi.

The final test for the value yielded by Eq. (5.8) is that set by Eq. (5.5), which calculates the frequency [the number of free transit vibrations per sec.] of the free (or natural) vibrations. The frequency as implied by $[\omega_n]_T$ should not exceed the frequency of the natural vibration of the shaft as implied by (ω_n) in Eq. (5.3) or Eq. (5.4). [NOTE:- In Eq. (5.8), the value (K) is defined by Eq. (5) as given on page 8, and the value (σ_c) is as per Eq. (5.6).]. The value of $[\omega_n]_T$ should, in point of fact, be substantially less than (ω_n) if the value of (d) as per Eq. (5.6) is to be accepted.

In Eq. (5.5), (d) is the value yielded by (5.8); (q) is approximately taken as 12,000 psi for modern steel; (g) is the gravity acceleration constant in inches per second squared; (w) is the weight of the unit in lbs.; (D) = the diameter of the rotor in inches; and (l) =

the unsupported, or cantilever, length of shaft in inches.

Briefly, if the value of (d_s) as predicted by Eq. (6-6) exceeds the limit, or criteria, established by Eqs. (6-7) and (6-7) combined, and then the test according to (6-8), with the conditions imposed above as regards the component magnitudes of (ω_N) and $[\omega_N]_T$, it may be said that the three-factor value for (d_s) can be accepted. Yes to any, that if the above is true and even if the value for (d_s) as per (6-8) fails to surpass the test as per Eq. (6-6), it may still be accepted. On the other hand, if the value for (d_s) exceeds (6-6), and (6-7) and (6-7) combined, then (6-8) can be neglected.

Finally as regards computational methods, it should be noted that if the value as per (6-8) fails to surpass the condition as commented on above, then a value for (d_s) as per Eq. (7-1) should be accepted and similarly tested.

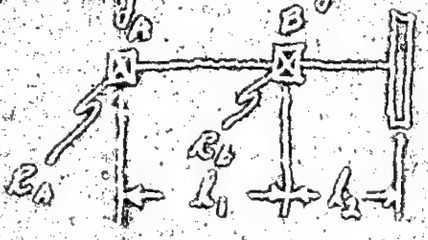
Before closing this section of this letter, I would like to point out the following regarding the larger significance of the above given and its rendered methods. Eq. (6-6), as previously noted, implies meant is the smallest size of shafting that can be selected, from the ranges of shafting diameter which we have at right to contemplate, properly spaced bearings of the same bore as the required diameter of shafting from the loads to which the shafting is subjected in bearing. [NOTE: I will give immediately after I finish these comments, the means for computing the bearing loads.] If, for the moment, we can assume that the bores of the bearings used for supporting the shaft will be equal to the diameter of the shafting. From this, it follows that the smaller the shafting, the smaller will the bearings be. Smaller bearings mean lower rubbing and/or lower rolling speeds, and, consequently, the lower mean loads which lower rubbing and rolling speeds favor. In general, the background of FM rewards, it is obvious that all factors tending to encourage lower speeds be exploited, for the FM rewards for the

suitable background for the selection of speed.

The only straightforward method which Eq. (43) appears to offer is to condition further combinations of speed and power which are likely to give rise to the most severe bending moments on the shaft. But even then, as has been pointed out, the selection of the speeds must be left to the judgment of the designer.

The above-described computational methods give the maximum bending moment which can occur in a shaft of the given speed and power. It is not unlikely, however, that either a slightly different speed or a different power, or a combination of both, may, by the variation in the vertical component of the drive's centre which they imply, lead to a disturbance which would mar the stability of the picture and appear as flicker to the eye.

I now wish to give the computational methods for determining the bearing loads. If (W_b) as determined by (41) or (42), and the loads in fully wound, and the corresponding value of (43) and the distances (a) are substituted in the following expression:-



$$\frac{\pi d^3}{32}(S) = M_b \qquad (44)$$

the bending moment tending to shear the shaft is obtained. Then the reaction (R) at Bearing B would be given by:-

$$\frac{M_b(l_1+l_2)}{l_2 l_1} = R_b$$

and the reaction (R_a) at Bearing A would be given by:-

$$\frac{M_b}{l_1} = R_a$$

I will now make a remark concerning the ground type of mounting shown, before I launch into the more difficult one. This consists of the

of running up and then at constant speed (as a function of speed) with the mechanical system, as the same when a shaft according to Eq. (48) is used. Eqs. (50) and (52) which show the relationship of the lateral displacement of the shaft to the ratio $\left(\frac{\omega_n}{\omega}\right)$ for the cases respectively when $\omega < \omega_n$ and $\omega > \omega_n$, are the first two equations of steady-state. They do not include the conditions pertaining during the unsteady state during start-up. Of interest, the dimensionless of the steady state for either (50) and (52) first is a constant ratio in regarding as known in the centrifugal force (F_c) on the shaft resulting on start-up; an increase in the lateral displacement of the shaft as (F_c) increases; and a stepping up of (F_c) as the lateral displacement of the shaft increases, etc. etc. Etc.

However more pertinent in which the curves of resulting speed-time of the shaft would lag behind the attaining of full-speed by the shaft. The condition means that during start-up the attainment of more or between the unsteady speeds and the lagging [illegible] of natural lateral vibration of the shaft as compared and then a coming of the system than its "normal" speed without damage unlikely predictable.

The steps are to the next topic which is what to find on in the text.

By the time I imagine that you must have received the note which I dispatched last Thursday. The note concerns an endless belt device which I felt would give comparable effects to those accomplished by the CBS color disc. It may be looked to [illegible] would consist of a [illegible] (set up to [illegible]), would cause a [illegible] and, would comply to the same standards of freedom from [illegible] as holds for the color disc.

The belt is to consist of a hundred of [illegible] of the [illegible] spaced [illegible] hundred to a hundredth [illegible] of a [illegible] color filter by a transparent [illegible]. The [illegible]

leave in the band both ends of the collapsible rubber tubing for the inward-facing surfaces of the cylindrical outside shell, and to glue the band to the inward-facing surfaces of the end-bearing plates with just enough cement to hold the rubber directly. The ends of the above tube is to be butt-welded to the rubber to form the sealed bulb. The edges of the bulb are to be perforated with a number of fine slots for engagement by matching projections, and the whole is to be protected against wear, and glued in its proper by a post-bound "envelope".

I regret that the drawings concerning this device which I intended to have ready for this meeting are not yet ready, but I will get them off by the very next mailing — which will be in a few days.

Since the mailing is travelling slower any week now, I'll have to work a little faster, sacrificing style and perhaps, a little of the logical sequence of the bulbs.

You will recall that in our recent meeting we built the figure of a segmented flexible tube in cylindrical section with the COS rubber sleeve, and an emptying of the steam light transmission properties of such perforated tubing and bulb as poly-methyl methacrylate, polystyrene, etc. in connection with such a device was mentioned. It was dismissed as a possibility because the principle involved in such a device would not be the filtration of all except the monochromatic component of the tube-emitted polychromatic (or white) light. Rather, it was desired that some other effect as would be obtained by such a device would consist of a deletion of the natural colors in the light that calls the retina back for review and re-examination, however, to the magenta chromatic colors which is why effect because it is desired that it gives "depth" and "life" to contrary black-and-white receptors. It's easy to imagine the probability of some of the colors and it provides the re-examination of the above-mentioned "white colors".

The "Columbia Lobster" gives a constant "land" [illegible]
under effect via a stationary pillow. If it gains a motion
with the advantage of an undergoing [illegible] effect, it
would seem to me that a "live" diaphragm effect such as the
above described action [illegible] would have a greater appeal.
It would work with the Columbia, would necessitate nothing
but the connection with most of the components of the CBS sound,
but it would be cheaper than the whole of the CBS action with its
electronic and diaphragming mechanisms.

I propose to detail such a scheme immediately after I have
finished the drawings for the above-mentioned endless belt
mechanism, —— that is, unless you inform me that such a
scheme would be out-of-question from a marketing point of
view. If it is, I should be delighted to call and discuss.

Within the next few days, I will complete and dispatch
the drawings for the "endless belt" motion. Until then, and
[illegible] should you may have concerning the enclosed or the
above, I would appreciate.

Yours,
A.B.

P.S. On the no-load method above made you, please
keep it confidential, as parties of it will involve [illegible]
patent applications.

A.B

P.P.S. Please let Goldfarb have a copy of the enclosed
paper. He ought to be helpful to him.

A.B

FD-141
(1-13-48)

BULKY EXHIBIT

Date received 6/23/51

ABRAHAM BROTHMAN, was

100-95068-1B
(Title of case)

Submitted by Special Agent JOHN M. COLLINS

Source from which obtained WARDEN E.R. THOMPSON

Address Federal Detention Headquarters, NYC

Purpose for which acquired Investigation

Location of bulky exhibit In cabinet with file

Ultimate disposition to be made of exhibit Retained

Estimated date of disposition - To be decided at conclusion of case

List of contents:

121. Two photostatic copies of letter dated 6/23/51 from Brothman to "Dear Herman" together with two photostatic copies of each of two pages entitled "SCHEMATICS".

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100-95068-1B

June 23, 1851

alignment (as Figs. II and III) of Lite #1 and Lite #2 will cause the color-filter sections of Lite #2 to complement the color-filter sections of Lite #1, so that a successful application of the color-filter to the light-screen of the Lenscope to accomplish black-and-white reception is obtained, regardless of the same mechanical alignment error will interpose the clear sections of both Lites between the Lenscope and the viewer, and the Lites will thereby with their over-lying clear sections as indicated above.

The sequence of explanation will be as follows, starting from the Lite adjusted for black-and-white reception:-

A) In the sending of the apparent Lenscope pictures to the point at the "color position", Lite #2 will be engaged to clear area, and set the hour-spool will be entered at a position such that the color-filter sections of Lite #1 and #2 will upon print and initial and final positions a continuous and uninterrupted application to proper areas of the color-filters;

B) when it reaches the color-application point for the particular Lite #2 will stop, and after a suitable delay, the Lite will be gradually engaged to interlace the Lenscope.

The sequence of explanation in going from color to black-and-white will be as follows:-

A) In the sending of the clear-portion pictures to the point at the "black-and-white position" the series of Lite Lite will be altered to their adjustment above explained;

B) the printing Lite and Lite #1 will be disengaged, and the clear sections of Lite #1 engaged to the viewer and the Lite #1 will be disengaged;

C) when Lite #1 has been disengaged Lite #2 moving to the clear adjustment will be engaged to the viewer and the clear sections of the Lite #1 will be clear to the [illegible]

after both have been signed as per (6) immediately above, they will also be stapled, placing both slips of paper in front of the cover.

I've got to stop now, the balance will be sent to Nairobi. Be available to us for the immediate transmission of all further instructions and descriptions. This is important that you be available to us immediately, and that you follow all instructions immediately and implicitly.

Adv.

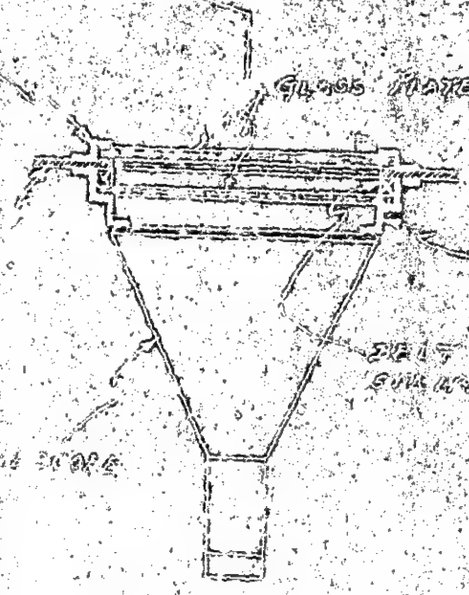


FIG. II. PLAN SECTION VIEW WITHOUT COLOR BELT SHOWN.

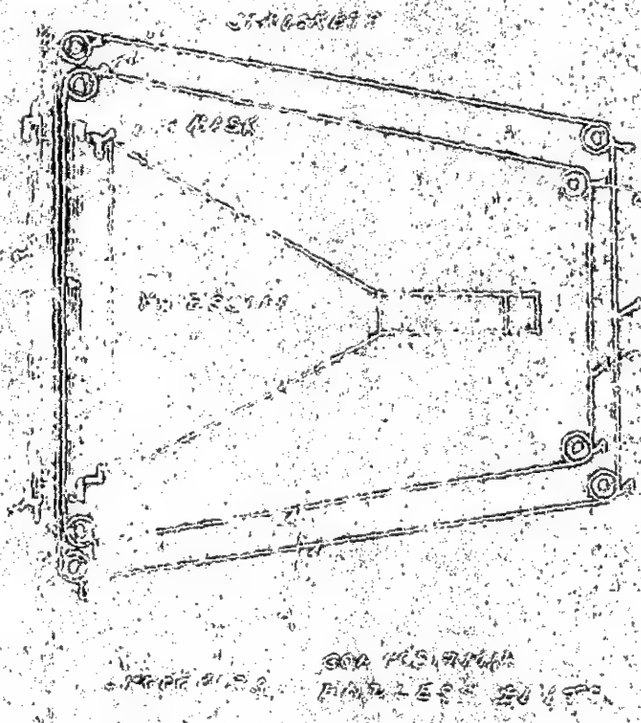
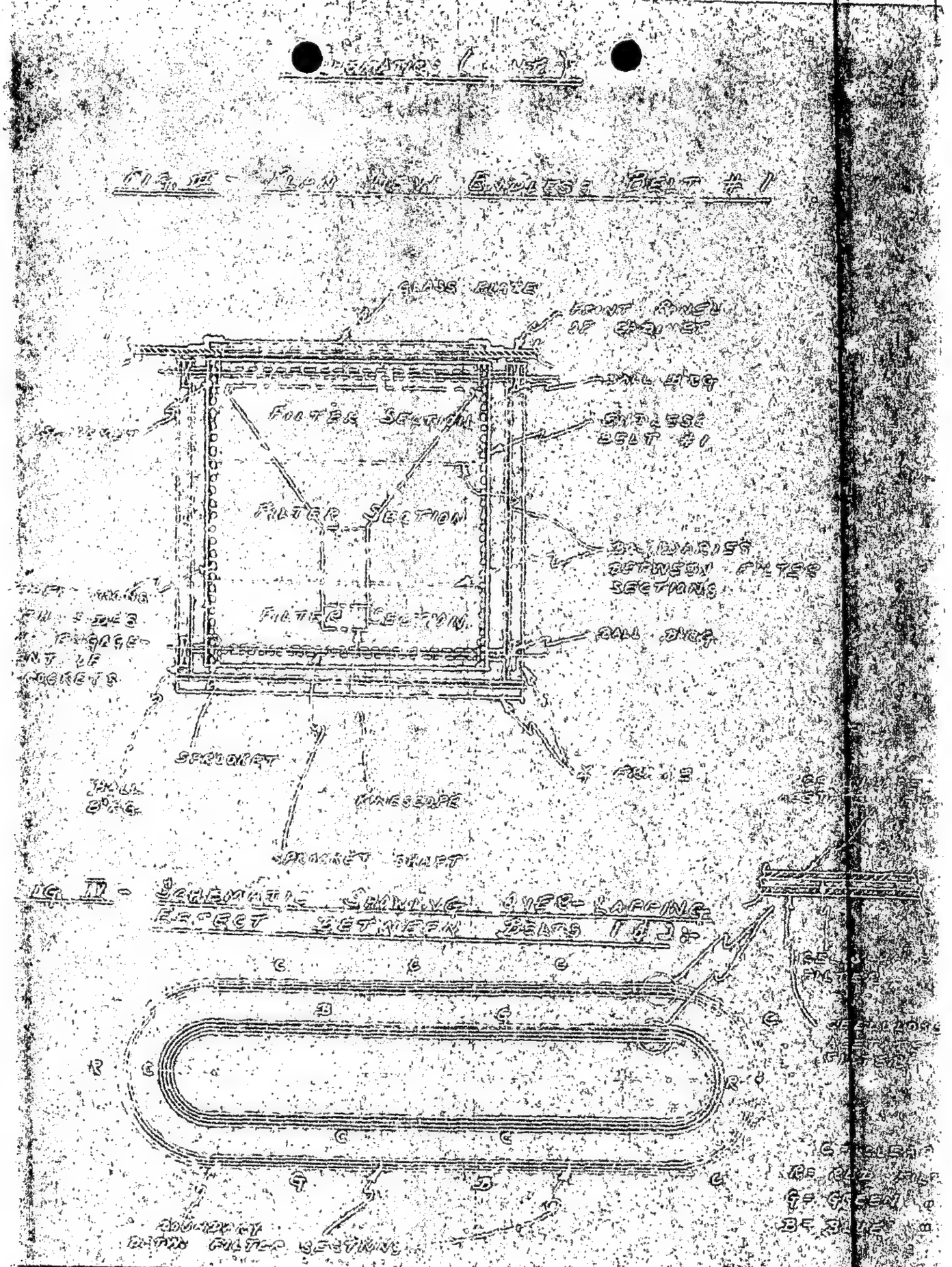


FIG. III. SIDE ELEVATION VIEW SHOWING BELT ARRANGEMENT (SECTION A-A)


GLASS PLATE
FRONT EDGE OF GLASS
FILTER SECTION
FILTER SECTION
FILTER SECTION
SPROCKET
SPROCKET SHAFT

June 23, 1857

Dear Thomas,

Without much explanation, I'm in the form you like
J.F. agrees that you the most fit coadjutor of the present
Pres of Monett and Jackson in bringing out the case adequate
with is outlined below in the enclosed schedules. I will, then
give duties in connection with the project below, after I get Jan with
the outline and then I connect with the details; so, if the mail-
man calls before I can get the outline done, then you might get
the same from them.

Regarding the schedules:

The object of the whole undertaking in the details is and
the CBS radio public and the schedules are to take up what the
figures, and at the same time to provide the framework for what we
shall write and not accept as such.

The overall schedules are to take up for public the
principle as proposed by the radio, the radio could have the
largest most point schedules only if the radio of time
will be accomplished the framework for the specific security and time
plans as applied on the details. The plans covering should have to
be changed to provide as separate outputs of the hourly (note: from
the end of the radio) and as separate outputs of the daily
(note: the plans should be planned and coordinated the radio late
broadcasting framework, and recommendations from the face of the radio
to the radio should be by way of radio radio).

The provide for schedules other and should and radio radio
the same hourly or daily plans as proposed. Part of each late
as time, supplement radio, face and the plans, and the plans and
late as other should, the supplied framework of radio the face
the hourly plans and supplied schedules, as radio plans should

alignment (as in Fig. II and III) of Belt #1 with Belt #2 will cause the color-filter sections of Belt #2 to superimpose the color-filter sections of Belt #1, so that a successive application of color-filters to the light-image is accomplished. Black-and-white reception is obtained, even during the period of lateral alignment of the belts, by causing the clear sections of both belts between the scanner and the viewer, and the belts themselves with their color-filter sections, to rotate at the above speed.

A system of apparatus will be as follows, starting from the belt adjusted for black-and-white reception:-

A) on the sending of the appropriate key on the push-face of the "color" panel, Belt #2 will be engaged for downward, and at the same speed, will be rotated at a proper speed that the color-filter sections of Belt #1 and #2 will superpose and in that speed and form plane a continuous and successive application of the color-filters;

B) when it reaches the color-superimposition position, Belt #2 will stop, and after a very short delay, Belt #1 will be firmly engaged to rotate at the same speed.

A system of apparatus to change from color to black and white will be as follows:-

A) on the sending of the color-control push-button key for the "black-and-white" system, the engaging belt will be released to their respective supports;

B) the friction drive belts will be released until the clear sections of Belt #1 appear in the viewer, and then Belt #1 will be disengaged;

and

C) when Belt #1 has been disengaged, Belt #2 continues to rotate at the same speed without color-filters, until the clear sections of the belt are in the position of the viewer.

The Bill has been engrossed for (3) immediately where it will
obtain the signal placing the Bill when filling in front of the Minister
for the to sign same. The Bill will be directed to
Name. Be available to her for the immediate transmission of
all further instructions and descriptions. Thus so important
that you be available to her immediately and that you follow
all instructions immediately and implicitly

Yrs.

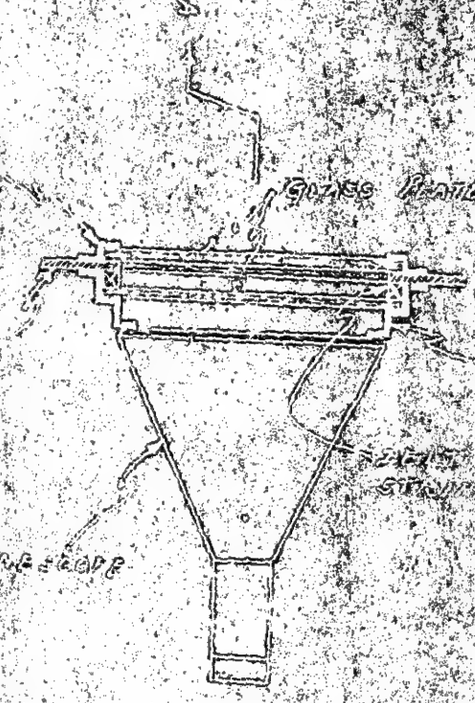


FIG. II PLAN SECTION VIEW WITHOUT CLOTH BELT SHOWN

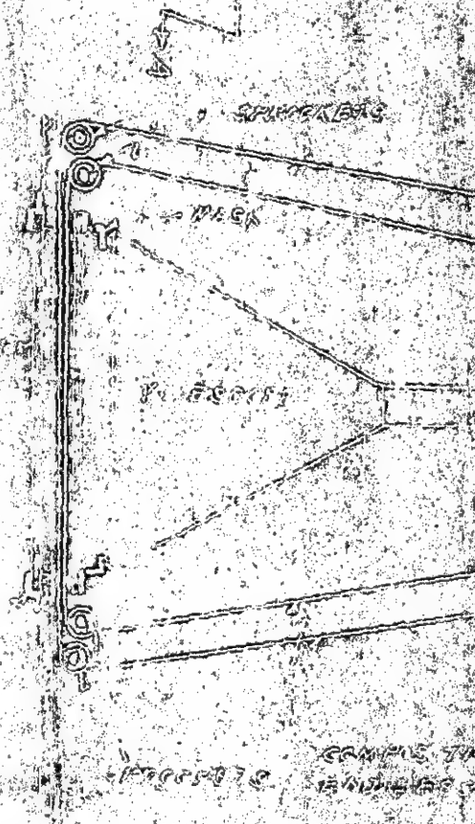
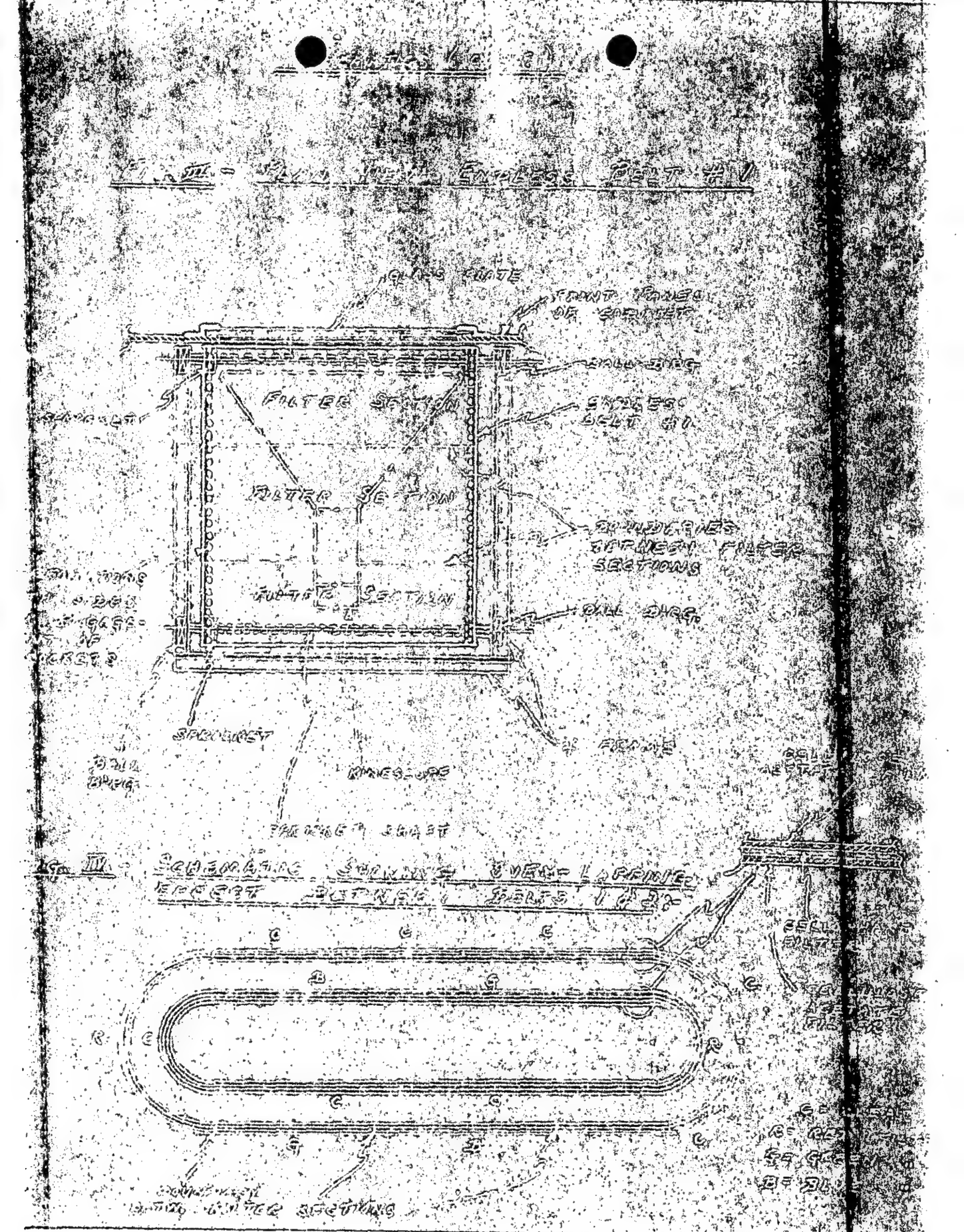


FIG. III SIDE ELEVATION VIEW SHOWING BELT (SECTION A-A)



FD-141
(1-18-48)

BULKY EXHIBIT

Date received 6/30/51

ABRAHAM BROTHMAN, was

100-95068-1B
(Title of case)

Submitted by Special Agent JOHN M. COLLINS

Source from which obtained Warden E. E. Thompson

Address Federal Detention Headquarters, N.Y.C.

Purpose for which acquired Investigation

Location of bulky exhibit In cabinet with file

Ultimate disposition to be made of exhibit Retained

Estimated date of disposition - To be decided at conclusion of case

List of contents:

122. Two photostatic copies of "Drum Type Color Wheel for Black & White and Color TV".

123. Two photostatic copies of "Layout Sketches for 20" Tube.

124. Two photostatic copies of memorandum addressed to Joe F entitled " Projection" Job.

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100-95068-1B

DRUM TYPE COLOR WHEEL FOR BLACK & WHITE & COLOR TV

Let us consider a drum composed of 6 plates (a view of the plate is shown in Fig. I) and let us assume that the drum will be used for a 20" tube. If the aspect ratio will remain

$$l \times h = A$$

Then

$$(1.25h) \times h = 20^2$$

$$h^2 = \frac{400}{1.25} = 156.25$$

$$h = 12.5"$$

$$l = 1.25(12.5) = 15.6"$$

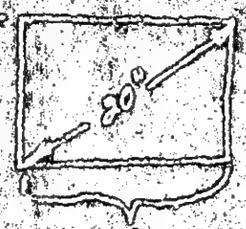


Fig. I

Now we should determine the dimensions of the plate. Since each plate is "cover" the picture, the dimensions would be assuming that

$$\frac{12.5}{\sin 30} = \frac{0.5}{0.5} = 25" = \text{radius of the Drum.}$$

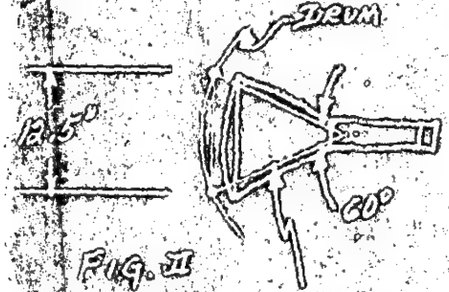


Fig. II

By using trigonometry the dimensions of the plate are found to be as shown in Fig. 3, in which the plate has a curved radius of 25" and a radius of 12.5". If there are 6 plates, each is $\frac{1}{6}$th of the circle, and their length would be 17", then each would have a volume of

$$\text{Vol} = l\left[\frac{\theta}{360}\right]\pi = \frac{3\pi(12.5)(17)(60)\pi}{360}$$

$$= 1337 \text{ cm}^3$$

and if specific gravity of lead is 11.3

$$\frac{62.5 \text{ lb}}{1728 \text{ in}^3} \times 11.3 \times 45.7 \text{ in}^3 = 164.5 \text{ lb}$$

would be the weight of each plate, which is 65.5 lbs. in the drum of radius 25" and the drum would be 17" long. The drum is driven by a motor of 1/3 H.P. 1725 rpm. The motor is geared down

$$\frac{1}{6}(1725) = 287.5 \text{ rpm for the 6 plates drum.}$$

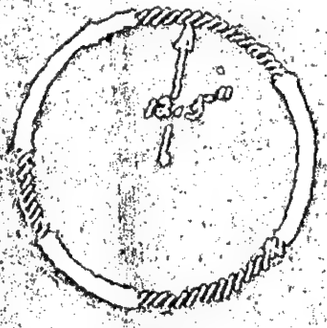


Fig. 3

The wound motor can supply a belt of

$$\frac{17.10 \frac{\text{cm-kg}}{\text{sec}} \left(2\pi \frac{\text{rad}}{\text{rev}}\right)}{60 \frac{\text{sec}}{\text{min}}} = 1.808 \frac{\text{cm-kg}}{\text{rev}}$$

The centrifugal force acting on each belt would then be:-

$$F_c = \frac{W}{g} v^2 r$$

$$= \frac{0.5 \text{ kg}}{9.8 \frac{\text{m}}{\text{sec}^2}} \cdot \left[20.0 \frac{\text{m}}{\text{sec}}\right]^2 \frac{12.5 \text{ cm}}{1 \text{ m}}$$

$$= 51.0 \text{ kg}$$

and with reliance might safely be said to belong under load

$$5.10 \frac{\text{kg}}{\text{belt}} \left(6 \text{ belts}\right) = 30.60 \text{ kg}$$

together, and

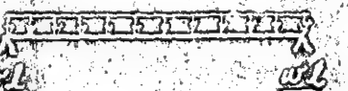
$$\frac{30.60 \text{ kg}}{2 \text{ strings}} = 15.30 \frac{\text{kg}}{\text{string}}$$

If steel the tensile stress in string to be 75% ultimate, would require a string of 70,000 kg/cm² would a 2% wind string would require a

$$\frac{15.30 \text{ kg}}{0.75 \text{ cm} \cdot (\pi)} = 14,000 \frac{\text{kg}}{\text{cm}^2}$$

$$\frac{15.30 \text{ kg}}{0.75 \text{ cm} \cdot (14,000 \text{ kg/cm}^2)} = 0.1458'' = C$$

Thick string. The shaft must also be reviewed as a uniformly loaded beam which is simply supported, with load $W = wl$



For C_1 & C_2

$$M = \frac{wx}{2}(l-x) = EI\left(\frac{d^2y}{dx^2}\right)$$

$$\frac{w}{2}(lx - x^2) = EI\left(\frac{d^2y}{dx^2}\right)$$

$$\frac{w}{2EI}\left(\frac{lx^2}{2} - \frac{x^3}{3}\right) + C_1 = \frac{dy}{dx}$$

But $\frac{dy}{dx} = 0$, when $x = \frac{l}{2}$, and so:-

$$\frac{w}{2EI}\left(\frac{l^3}{8} - \frac{l^3}{24}\right) + C_1 = 0$$

$$C_1 = -\frac{w}{2EI}\left(\frac{l^3}{12}\right) = -\frac{wl^3}{24EI}$$

and so

$$\frac{dy}{dx} = \frac{w}{2EI}\left(\frac{lx^2}{2} - \frac{x^3}{3}\right) - \frac{wl^3}{24EI}$$

$$y = \frac{wx}{24EI}\left(\frac{L^3}{3} - \frac{x^3}{12} - \frac{L^3 x}{12}\right) - \frac{wL^3 x}{24EI} + C_2$$

But, since $y = 0$ when $x = 0$, then

$$C_2 = 0$$

and

$$y = \frac{w}{24EI}\left(\frac{Lx^3}{3} - \frac{x^4}{12} - \frac{L^3 x}{12}\right)$$

At $x = \frac{L}{2}$, at the center, slope (y) would have its maximum value, and y max. would be given by:-

$$y_{max} = \frac{w}{24EI}\left(\frac{L^4}{48} - \frac{L^4}{192} - \frac{L^4}{24}\right)$$

$$= -\frac{5wL^4}{384EI} = -\frac{5WL^3}{384EI}$$

The given method from for computing the deflection, and the slope, in the table when the table have up to full beam applied. It is necessary to develop the value of (I) for the shape.

Fig. II

The slot first for common radius shown $r = 0.4$" and $1\frac{1}{2}$" (radius would be $0.4 + 1\frac{1}{2}$") would be the number of degrees of the slot subtended by angle θ with respect to the axis $x'x'$. To find the area moment of inertia of the slot is approximately by

$$\frac{\theta}{360}(2\pi r_{mean})\,2r = \frac{\frac{1}{12}(2\pi)(0.4 + \frac{1}{2})(60)}{360} = 0.022\text{ in}^2$$

I_{xx} (II) would be the I of area around x

$$A_1 y_1^2 = 0.022\left(1\tfrac{1}{2}\right)^2 = 1.98\text{ in}^4$$

The center of gravity of the slot would be given by:-

$$y_0 = \frac{r_{mean}\sin\theta}{\theta} = \frac{(1\frac{1}{2})(\sin 30°)}{\frac{\pi}{6}} = \frac{1.57"(0.5)}{0.5236} = 1.5"$$

$y_1(x_1)$ is the amount of movement of the point section about 375 mm due to gravity, then

$$I_{eff} = I_0 + A y_1^2$$

and for

$$129 \text{ in}^4 = I_0 + 0.822 (11.75)^2$$

$$129 - 0.822(11.75) = 129 - 113.5 = 15.5 \text{ in}^4$$

From this, it follows that

$$y_{max} = \frac{5WL^3}{384EI} = \frac{5(4.10)(17)^3}{384(29)(10^6)(15.5)} = 0.0102 \text{ in}$$

which is acceptable if the above end moments are reasonable ones.

$$y_{max} = \frac{5WL^3}{384EI}$$

and

$$M_{max} = \frac{WL}{8} = \frac{WL}{C}$$

Therefore

$$y_{max} = \frac{WL}{C} \cdot \frac{5L^2}{48EI} = \frac{5ML^2}{48EI}$$

But

$$M = SZ$$

where

M = Maximum moment in the beam = in-lbs
Z = Section modulus of the beam = in^3
S = Stress induced in the beam = psi

and

$$\frac{I}{C} = Z$$

where

C = distance of the extreme fiber from the neutral axis of the beam

and then

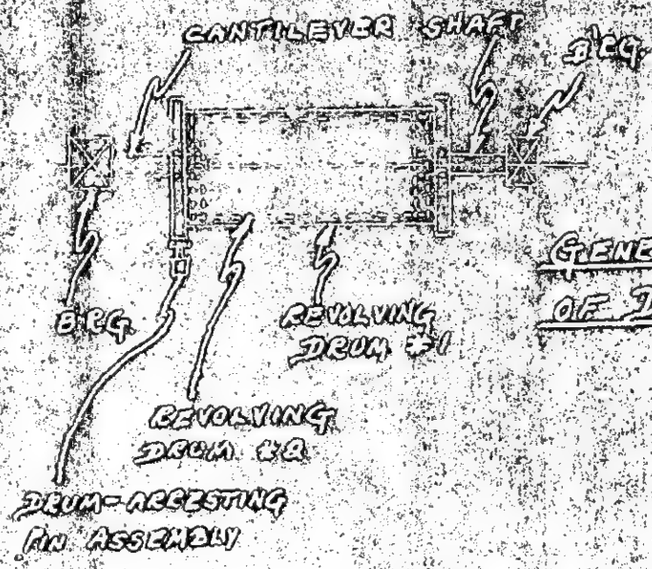
$$y_{max} = \frac{5(S)\left(\frac{I}{C}\right)L^2}{48EI} = \frac{5SL^2}{48EC}$$

By the question,

$$0.0102 \text{ in} = \frac{5\left(\frac{15.5}{11.3} - 11.3\right)(17^2)S}{48(29)(10^6)} = \frac{5(0.822)(17^2)S}{48(29)(10^6)(11.3)}$$

$$\frac{1.192\,(0.0102)(48)(29)(10^6)}{5(0.822)(17^2)} = S = 8.39 \text{ k/in}^2$$

NOTE:- DRUM #1 TO CONSIST OF 5 COLOR FILTERS, AND 1 WHITE LIGHT SLAT; DRUM #2 5 WHITE LIGHT SLATS, AND 1 COLOR SLAT COMPLETING 2 SERIES FOR DRUM #2

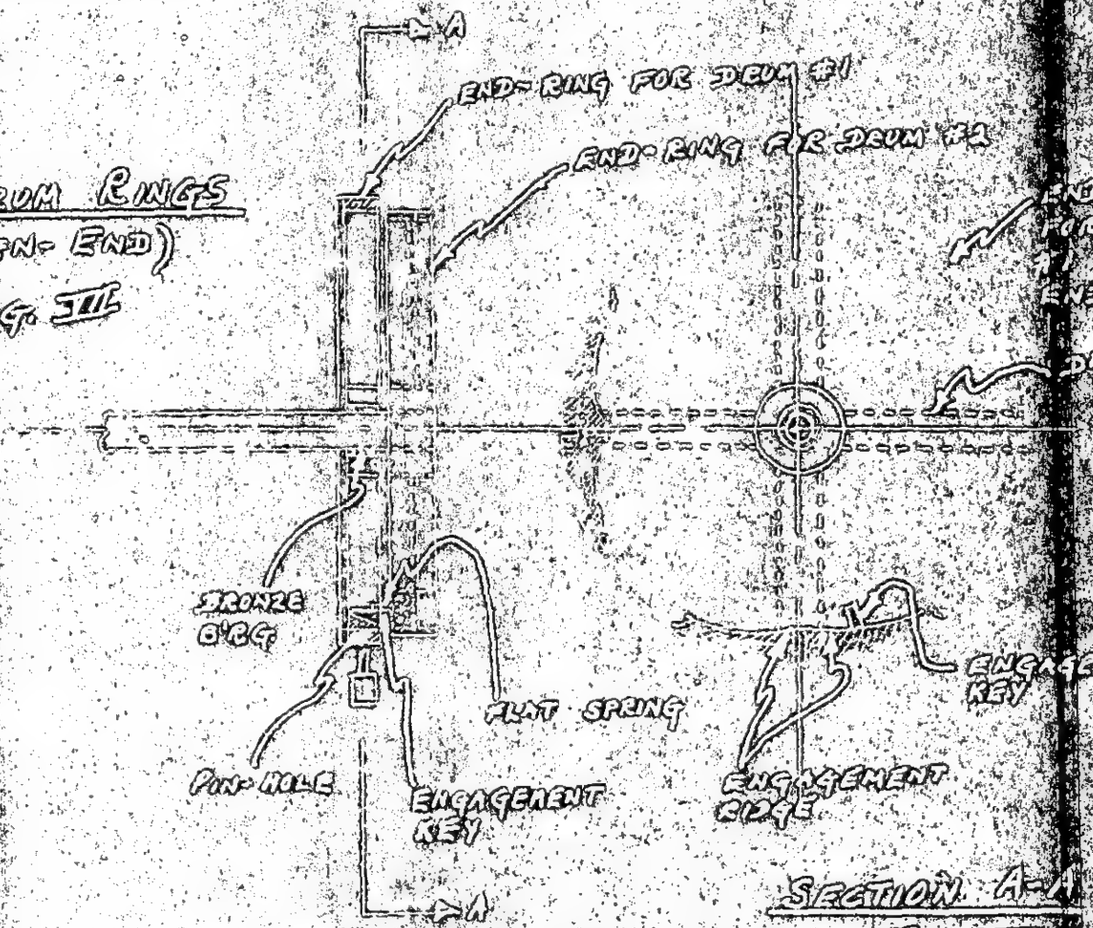


GENERAL ARRANGEMENT OF DRUM SUPPORT

FIG. VI

DRUM RINGS (DRIVEN-END)

FIG. III



SECTION A-A

FIG. III

In approximate the combined weight of the drum, this may be assumed as follows:

12" width = 17" length

$$\frac{2\pi r\theta}{360} = \frac{2\pi(12.5)(60)}{360} = 13.1''$$ wide.

and $\frac{1}{16}$" thick

would weigh

$$\frac{12(17)(13.1)(0.0625)(62.5)(16.18)}{1728} = 7.17\#$$

and, if we estimate end ends may at 3#, the drum ring would weigh 10# in total, to give a total weight of approximately 20#. This could be used to give a moment of inertia of approximately 15 $\frac{1}{2}$ giving the drum a Σmr^2 of

$$\Sigma mr^2 = 20\left(\frac{15}{12}\right) = 23.5 \text{ lb-ft}^2$$

The rim of the drum is also to attain a velocity of 150.8 $\frac{\text{ft}}{\text{sec.}}$).

$$\frac{23.5}{2(32.2)}(150.8)^2 = 16,700 \text{ ft-lbs.} = 8,350 \text{ ft-lbs.}$$

of energy is required in the form of flywheel energy. Should windmill, the wheel become a large rotary and it would be desirable to reduce the diameter to the value of the indicated figure. But we therefore reduce the weight of the drum, and particularly the amount at the individual radius of application by setting in 3" limit for the 4" radius in steel. In that case,

$$\frac{10.17}{12.5}(16,700) = 13,600 \text{ ft-lbs.} = 3620 \text{ ft-lbs.}$$

would be the required flywheel energy. And if the wind supplied in 60 secs.

a

$$\frac{3620 \text{ ft-lbs.}}{(60 \text{ secs.})\left(550 \frac{\text{ft-lbs.}}{\text{sec.-hp}}\right)} = 0.105 \text{ hp}$$

multi-drive would be required.

In bringing the drum down by to a stop, let us assume that 60 secs. is satisfactory. Then the angular acceleration of

$$a = \frac{\Delta V}{t} = \frac{(150.8 - 0)}{50} = 3.03 \frac{\text{rads.}}{\text{sec.}^2}$$

is satisfactory, and the torque-arm of the brake would have to be

$$\frac{10.17}{32.2}(3.03) = \text{[illegible]} \text{ ft-lbs.}$$

If a 1hp motor is applied to a mechanical brake, the required force of a caliper on a 12" rotor is:

$$\frac{1.5\,hp \cdot 550\,\frac{ft\text{-}lb}{s}\cdot 60\,\frac{s}{min}}{(\pi)(12\,in)\left(\frac{1\,ft}{12\,in}\right)} = 1547\,ft$$

braking force. If an eddy-current brake were to be used, it would have to be connected with a

$$\frac{3600\,\frac{rev}{min}\,(1547\,ft\text{-}lb)}{60\,\left(\frac{sec}{min}\right)} = \frac{(2\pi)\,rad}{rev}\,\frac{ft\text{-}lb}{sec}$$

energy consumption is required. The electrical electricity of the brake would then have to be:

$$\frac{60\,\frac{s}{min}}{550\,\frac{ft\text{-}lb}{s\text{-}hp}}\left(0.746\,\frac{kilowatt}{hp}\right) = \frac{0.0845}{\text{consumed}}\,kW$$

but because eddy current brakes are quite inefficient, the actual brake rating would have to be substantially larger. A mechanical brake applied to the output shaft of the driving motor also dissipates considerable

The question arises of applying the braking force until the motor's maximum speed is attained, and then leaving it to the pulsing thereafter. This is being left to a full-stop for the continuous pulsing of the and disengagement of the drive from the motor. Assume the use of a ¼" diameter round pin made of cast iron ($E = 12 \times 10^6$ psi). By the formulas (for cantilever beams)

$$M = Pl = SZ = S\frac{I}{c}$$

$$f = \frac{Pl^3}{3EI}$$

one finds that

$$f = \frac{Sl^2}{3Ec}$$

Using this formula, and setting for a stress limit not to exceed 75% of the elastic limit, and setting the elastic limit at 30,000 psi, then for a material for which $E = 12(10^6)$

$$f = \frac{0.75\left(30{,}000\,\frac{lb}{in^2}\right)(2\,in)^2}{3\left(12\times10^6\,\frac{lb}{in^2}\right)\left(\frac{1}{4}\,in\right)} = 0.02\,ft\text{-}in$$

Similarly, the pin would be serving as a spring along its length, and $f^{(K)}$ represents the force that is the spring constant of

deflection, then

$$W(\text{work stored in the spring}) = \int_{y=0}^{y=f} Ky\,dy = \frac{Kf^2}{2}$$

where f = the limiting deflection of the spring. Thus, if we re-arrange the equation

$$f = \frac{PL^3}{3EI}$$

to the form

$$\frac{3EI}{L^3} = \frac{P}{f} = K = \frac{3\pi Ed^4}{L^3}$$

we find that

$$K = \frac{3\pi (29\times10^6\ \#/in^2)(1/4)^4}{2^3} = 119{,}500\ \#/in.$$

Now by this, the work stored by a deflection of 0.0024" would be

$$\frac{1}{2}(119{,}500\ \#/in.)(0.0024)^2 = 5.08\ in\text{-}lbs.$$

or

$$\frac{5.08\ in\text{-}lbs.}{12\ \frac{in}{ft}} = 0.423\ ft\text{-}lbs.$$

of energy. This would limit the weight of the drum to

$$0.423 = \frac{W(0.07)^2}{2(32)}$$

$$\left[\frac{64(0.423)}{W}\right]^{1/2} = \omega = [3.45]^{1/2} = 1.86\ rads./sec.$$

where the positive pin on the ω = the required arm. That is, the stick of the brake would be raised, the drum slowly sped from 150.8 rads./sec. to 1.86 rads./sec. after which the pin would strike the arm of the escapement allowing the drum to rotate a full step.

Assuming the use of a 4 to 1 transmission ratio drive and assuming a 130° spiral before the drum is brought from rest and subsequently returned to rest, we must provide for the design of the escapement assembly.

The velocity of the Drum #2 assembly at the end of the above-mentioned 120° travel can be arrived at by applying the ratio of the specified motor, to the computed required motor, to the acceleration on which the computed motor is based. Thus, the computed required motor would raise the speed of the Drum Assembly from zero to 150.8 radians/sec in 60 secs., or an acceleration of

$$150.8 = \frac{1}{2} a (60)$$

$$\frac{2(150.8)}{60} = 5.03 \text{ rads./sec.}^2$$

Using a 0.125 HP motor in the place of the 0.105 HP computed requirement, we may take

$$\frac{(0.125 \text{ HP})}{(0.105 \text{ HP})} \left[5.03 \text{ rads./sec.}^2\right] = 5.98 \text{ rads./sec.}^2$$

to be the acceleration which the specified motor would apply. The 120° arc of travel constitutes a travel of

$$\frac{120}{360}(2\pi) = \frac{2}{3}\pi \text{ radians}$$

The above-given acceleration of 5.98 rads./secs. would be applied to an assembly with a Σmr^2 of 10.17 lb.-ft.^{2}, while in the motivating of #2 Drum alone roughly one-half of this Σmr^2 is involved, meaning that the acceleration of the #2 Drum (assuming the same motor output torque) would be

$$2(5.98) = 11.96 \text{ rads./sec.}^2$$

By

$$S = \frac{1}{2} at^2$$

$$\frac{2}{3}\pi = \frac{1}{2}(11.96)(t^2)$$

$$t = \left[\frac{2(2\pi)}{3(11.96)}\right]^{1/2} = 0.35^{1/2} = 0.592 \text{ secs.}$$

would be the time required to move thru the mentioned arc; and

$$\frac{1}{2} at = \frac{1}{2}(11.96)(0.592) = 3.54 \text{ rads./sec.}$$

would be the drum velocity at the conclusion of the arc of travel. The fact
There are two criteria by which the latch which positions Drum #2 with respect to Drum #1 may be designed. These two criteria produce

If the two functions which the flat cover is (1) partly to serve to stop and guide Drum #2 while Drum #1 takes slack-and-cloth during its entire [illegible] and (2) to be means by Drum #1 is instructed along with Drum #2 in slat-driving. In stopping Drum #2 after Drum #1 has already been provided, it must absorb the flywheel energy of Drum #2. This would mean, since Drum #2 and Drum #1 have taken at 7.085 lb-ft.², that

$$\frac{(7.085\ \text{lb-ft.}^2)}{(2)(32\ \frac{\text{ft.}}{\text{sec.}^2})}\left(3.77\ \frac{\text{rads.}}{\text{sec.}}\right) = 0.382\ \text{ft-lbs.}$$

of energy would have to be absorbed. By reference to the previous calculations concerning the gear which positions Drum #1, it is clear that a pinion with a pitch diameter equal to a 1/4" round would not have enough for the service, if not more longer than the [illegible] for. According to the second criterion for the design of the latch mechanism, it would be required at a maximum [illegible] a torque equal to

$$\frac{(10.17\ \text{lb-ft.}^2)}{(32\ \text{ft./sec.}^2)}\left[3.77\ \frac{\text{rads.}}{\text{sec.}}\right] = 12.71\ \text{ft-lb.}$$

or

$$(1.059\ \text{ft-lb})\left(12\ \frac{\text{in.}}{\text{ft.}}\right) = 22.45\ \text{in-lbs.}$$

[illegible] from the main gear train, the torque exhibited when [illegible] a load of

$$\frac{22.45\ \text{in-lbs.}}{1.25\ \text{in.}} = 17.95\ \text{lbs.}$$

at the ending latch. The latch spring would then be ending [illegible] a bending load of

$$1.75(2) = 3.456\ \text{in-lbs.}$$

which was, in fact, [illegible] adequately for further computations.

The key to the matter of the slotting by which the Drums are controlled. One recommendation of the [illegible], individual, it is practical, from a superficial observation, [illegible] in terms of a cantilever clamping mounting of the Drums from one end as per the figure below:-

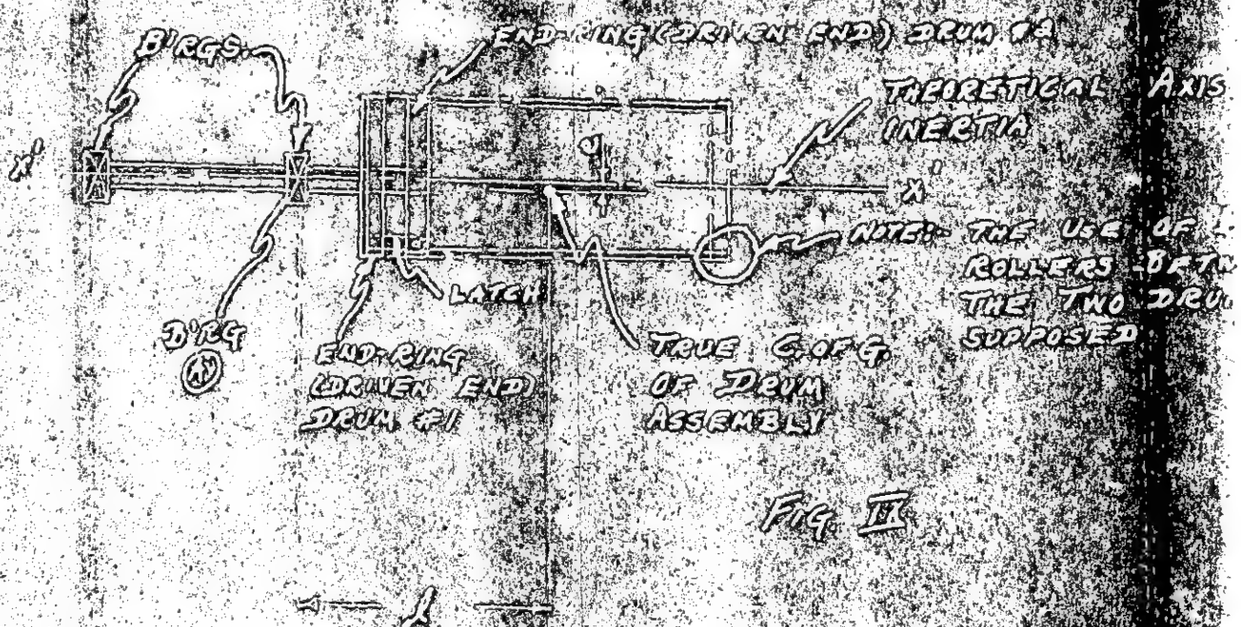
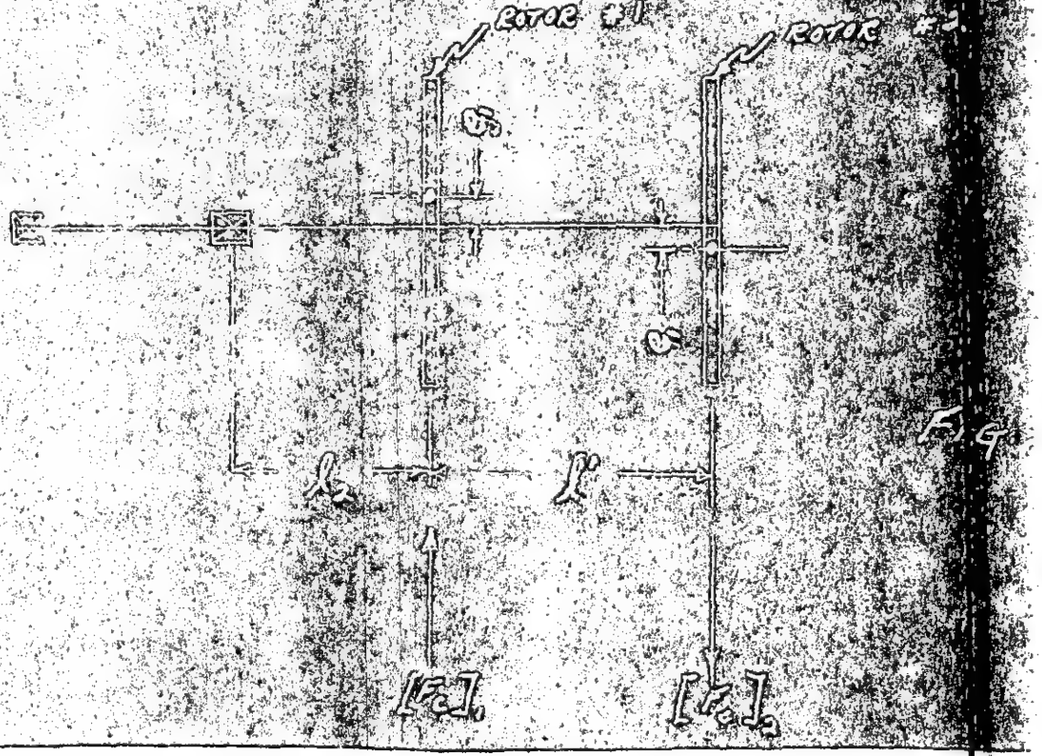
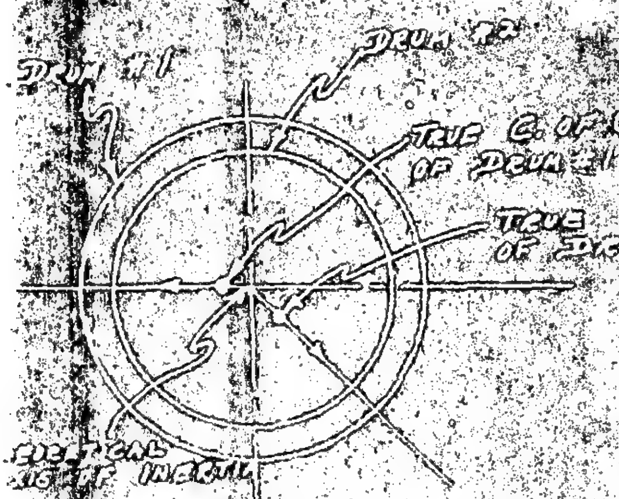

B'RGS.
END-RING (DRIVEN END) DRUM #2
THEORETICAL AXIS
INERTIA
NOTCH
THE USE OF
ROLLERS BE
THE TWO DRU
SUPPOSED
LATCH
B'RG
END-RING
(DRIVEN END)
DRUM #1
TRUE C. OF G.
OF DRUM
ASSEMBLY

FIG. III


ROTOR #1
ROTOR #2
FIG.



SCHEMATIC END VIEW OF ASSEMBY (DRUMS)

FIG. XI

The support taken above is, fundamentally, a simplified and idealized one. It is in opposition to the view which considers the shaft to carry two distinct concentrated loads. Considering the shaft as carrying two distinct concentrated loads, there is room for only two possibilities (assuming that each drum has been fabricated to identical tolerances as to balance). These possibilities are illustrated in Figs. 10 and XI, where:-

a. Fig. 10 illustrates the situation in which two rotors of identical weight but of diametrically-opposed identical eccentricities are mounted on the same shaft;

and,

b. Fig. XI illustrates the situation in which two rotors of identical weight have their identical eccentricities acting in different axial planes.

Analyzing the situation presented by Fig. X, it is clear that since the eccentricities of both rotors are identical, each would — to begin with — exert a centrifugal force on the shaft, as given by:-

$$F_{c_1} = F_{c_2} = \frac{W}{g}\omega^2 e$$

But since (F_{c_1}) and (F_{c_2}) act in opposite directions, in consequence of their diametrically-opposed eccentricities, they would constitute a rotational moment (or rotational couple) of magnitude

$$\frac{W}{g}\omega^2 e l$$

For so long as the rotational couple persists, it would subject each and every section of the shaft to the left of ($l_3 + l/2$) to an upward rotation, and every section to the right of ($l_3 + l/2$) to a downward rotation. Quite obviously the mentioned portions of the span would present different resistances to the couple, and would consequently result in

depending on the difference from the Neutral axis of centre of difference
at $x = l_2$ and $x = l_2 + l'$. Now the different magnitude
the relative magnitudes of (F_{c_1}) and (F_{c_2}), the couple would be des
and the actual couples would then be pictorially

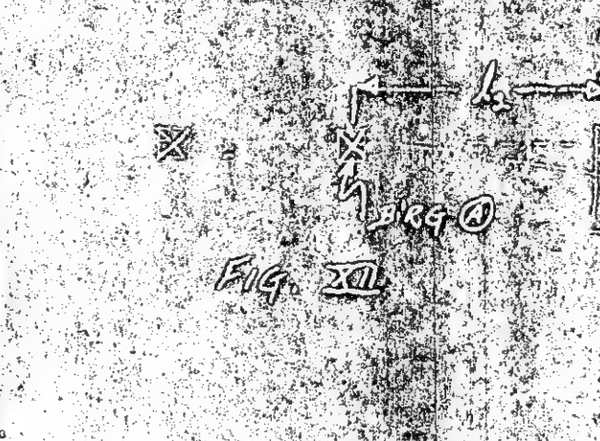


Fig. XCI

In other words, a situation in which the forces (F_{c_1}) and (F_{c_2}) a
resolved according to

$$\frac{(F_{c_1})(l' + l_2) - (F_{c_1})l_2}{(l_2 + l')} = F_R$$

into a resultant force (F_R) acting at a lever arm of $(l_2 + l'$
Fig. (XCI). The moment acting on any section of the beam would
be given by:-

$$M_x = F_R(l' + l_2 - x) = EI\frac{d^2y}{dx^2}$$

which, after two successive integrations, would take the form

$$y = \frac{F_R}{EI}\left(\frac{(l_2 + l')x^2}{2} - \frac{x^3}{6}\right)$$

to give the shape, when considered as a spring, a K value

$$K = \frac{EI}{\left[\frac{(l' + l_2)x^2}{2} - \frac{x^3}{6}\right]}$$

From Fig. XCI, it follows that

$$F_{c_2} = \frac{W}{g}(g_1 - e)\omega^2$$

and

$$F_{c_2} = \frac{W}{g}(y_2 + e_1)\omega^2$$

Moreover, since

$$F_{c_2} + F_{c_1} = K y_2$$

we may write

$$\frac{W}{g}(y_2 - e_1)\omega^2 + \frac{W}{g}(e_1 + y_2)\omega^2 = K y_2$$

which will reduce to

$$\omega^2(y_2 + y_2) = \frac{K}{W} y_2 g$$

$$\frac{\omega^2 y_2}{\frac{K}{W} - \omega^2} = y_2 = \frac{y_1}{\left(\frac{K}{W\omega^2}\right) - 1}$$

The significance of the final equation is that

a) as (ω^2) approaches $\left(\frac{K}{W}\right)$ in value, (y_2) would attain extremely large values, meaning infinite amplitude when $\omega = \sqrt{\frac{K}{W}}$ (i.e. the shaft would fail);

and

b) since (y_1) is expressed in terms of (y_2) with $\left[\frac{K}{W\omega^2} - 1\right]$ as a multiplier, it is also that value which causes $\omega < \left(\frac{K}{W}\right)$ to appear to factor as negative, the shaft rotates in opposite direction to that assumed in the original sketch, which is to say that y_2 will be negative when $\omega > \left[\frac{K}{W}\right]$, the final equation becomes

$$y_2 = \frac{y_1}{1 - \frac{K}{W\omega^2}}$$

meaning that the motion of the shaft above the critical speed is in the opposite direction.

The interesting property of $\frac{K}{W}$ is especially susceptible of analysis, in that the double-beam assembly should be considered as two independent concentrated loads, for each of which a deflection equation is to be written, the sum of the two equations being the total deflection. When (y_2) is entirely equal to $(y_1 + e_1)$, the shaft is bent into a half-circle, with the ends of the shaft at the center of the circle.

between (y) and (y') in feet of flow, adjacent to the normal depth
relationship. The condition curve, known as the M curve, is a
relationship between (y) and (y'). As curves approach normal depth
at upstream from the first intermediate point, and, in fact, the relationship
upstream from the first intermediate point, and, in fact, the relationship
in steeply sloped channels with the first intermediate point being
the only section where critical depth occurs. Hence, critical depth is established by the
only convenient load equation.

Rectangular channel, $b = 3$ ft, $Q = 50$ cfs, $n = 0.017$

$W = 10.17$ ft

$A = 17$ ft²

$S = 1500$ ft/ft

$\omega = 150$ lb/cu ft, unit weight

$E = 1.5$ ft, channel depth, with the unit discharge

$g = \left[32 \frac{ft}{sec^2}\right]\left[12 \frac{in}{ft}\right] = 384 \frac{in}{sec^2}$

$E_1 = 2.5(0.5) = 1.25$ ft-lb/cu ft

Now using $C_f = (1.7)$ of "Hydraulics" by Ven Te Chow, p. 89 of "Handbook of Hydraulics"

$$\frac{\pi S_f d^4}{3 A_1 W_1 w^2} - E d + \frac{2 S_f L^2}{3 E_f} = 0$$

$$\frac{\pi (1.5)(0.5)(1.5) d^4}{3(17)(10.17)(150)} - 0.5 d + \frac{2(1.5)(0.5)(1.5)^2}{3(3.6)(10.5)} = 0$$

$$0.175 d^4 - 0.5 d + 0.0754 = 0$$

$$d^4 - 2.8 d + 0.43 = 0$$

In the above equation,

$4A = 0.0$, $A = +0.0$

$6B = 0$, $B = +0.0$

$-0.8 = 4C = 3D$, $C = -0.2$, $D = -0.43$

Now, solving

$g = A^4 - B = 0 - 0 = 0$

$h = E^4 + C^4 - 3AB^2 + Dg = 0 + 0.04 - 0 + 0 = 0.04$

$k = \frac{1}{3}[a + (b^2 + k^2)^{1/3} + (b - (b^2 + k^2)^{1/3}] =$

$\frac{1}{3}[0.4 + (0.016 + 0.0029)^{1/3} + (0.0 + (0.016 - 0.0029)^{1/3}] =$

$\frac{1}{3}[0.07 + 0.164] + \frac{1}{3}[0.04 + 0.10^2] =$

$0.103 + 0.071 = 0.176$

$u = g + d = 0 + 0.176 = 0.176$

$v = 2g + k = 0 + 0.176 = 0.176$

$w = 4u^2 + 3k = 16g^2 + 4(0.176)^2 + 3(0.143) - 12(0) =$

$= 4(0.031) + 0.429 = 0.124 + 0.429 = 0.553$

Now, the four roots would be:

$d_1 = -h + u^{1/2} + (v + w^{1/2})^{1/2}$

$d_2 = -h - u^{1/2} + (v - w^{1/2})^{1/2}$

$d_3 = -h + u^{1/2} - (v + w^{1/2})^{1/2}$

$d_4 = -h - u^{1/2} - (v - w^{1/2})^{1/2}$

and now,

$d_1 = -0 + 0.176^{1/2} + (0.176 + 0.553^{1/2})^{1/2} = 0.42 + [0.176 + 0.742]^{1/2}$

$= 0.42 + 1.393^{1/2} = 0.42 + 0.966 = 1.386''$

By inspection, the four other roots would be in the order of magnitude of the imaginary or unpractical value. Checking

$d^4 - 0.5d - 0.43 = 0$

$1.386^4 - 0.5(1.386) - 0.43 = 0$

$3.67 - 1.083 - 0.43 \neq 0$

and, now the above value is incorrect. Taking d_1 as follows:

$k = \frac{1}{3}[a + (b^2 + k^3)^{1/2} + \frac{1}{3}[a - (b^2 + k^3)^{1/3}] =$

$\frac{1}{3}[0.07 + 0.164] + \frac{1}{3}[0.04 - 0.164] =$

$= \frac{1}{2}[0.204 - \frac{1}{2}(0.142)] = [0.204 - 0.062]\,1/2 =$

$+\frac{1}{2}[0.142] = 0.071$

$u = 0.071$

$v = 0.071$

$w = 4(0.071)^2 + 0.43 = 4(0.005) + 0.43 =$

$0.02 + 0.43 = 0.45$

$d_1 = 0.071^{1/2} + (0.071 + 0.45^{1/2})^{1/2} = 0.276 + (0.071 + 0.67)^{1/2}$

$= 0.276 + 0.741^{1/2} = 0.276 + 0.86 = 1.136$ "

Checking:

$d^2 - 0.126 - 0.43 = 0$

$1.66 - 0.5(1.136) - 0.43 = 0$

$1.66 - 0.9088 - 0.43 \neq 0$

Again, taking $[h + (h^2 + k^3)^{1/3}]^{1/3} \; \& \; [h - (h^2 + k^3)^{1/3}]$

$L = \frac{1}{2}[h + (h^2 + k^3)^{1/3}]^{1/3} \; \& \; [h - (h^2 + k^3)^{1/3}] =$

$\frac{1}{2}[0.204] + \frac{1}{2}[-0.134] = 0.102 - 0.062 = 0.04$

$L = 0.04$

$V = 0.04$

$W = 4(0.04)^2 + 0.43 = 4(0.0016) + 0.43 =$

$0.0056 + 0.43 = 0.4356$

$d_1 = 0.04^{1/2} + (0.04 + 0.4356^{1/2})^{1/2} =$

$0.2 + (0.04 + 0.66)^{1/2} = 0.2 + 0.7^{1/2} =$

$0.2 + 0.835 = 1.035$ "

Checking

$d^2 - 0.84 - 0.43 = 0$

$1.14 - 0.5(1.035) - 0.43 = 0$

$1.14 - 0.828 - 0.43 = 0$

This answer may be taken to be within the limits of desired accuracy and we could use a value of all the three digits after the decimal point.

The previously found 16" torque in accordance with Diagram To be of the order of 22,750 in-lbs. Using the "shock torque" to be 1.5 times the value according to Eq. 56 of "Shafts from a Dynamic Viewpoint".

$$22.7\left[\frac{M_t}{C}\right]^{1/2} = 22.7\left[\frac{(1.5)(15{,}000)}{\pi(16)}\right]^{1/3} =$$

$$0.827\left[\frac{53{,}625}{\tau_s}\right]^{1/3} = 0.827(15) = 0.521''$$

& shaft would be required to yield a more than a 1°/20 diameter of shafting stock. Finally, we find, by Eq. 58 of "Shafts from a Dynamic Viewpoint",

$$\frac{16\,M_t}{\pi d^3} = S_s$$

If again we use $M_t = 53{,}625$ in-lbs torque and $d = 1.125''$ (as previously suggested)

$$\frac{16(1.5)(53{,}625)}{\pi(1.125)^3} = \frac{24(53{,}625)}{\pi(1.266)} = 12{,}100\ \#/in^2$$

would be the shear stress set up. The combined bending shear stress and bending would then be:-

$$\left[15{,}000^2 + 12{,}100^2\right]^{1/2} = \left[2.25(10^8) + 1.47(10^8)\right]^{1/2} =$$

$$19{,}300\ \#/in^2$$

and hence, a 1⅛" diameter shaft satisfies the principle design criterion. Let us now check the value of maximum speed which we could impose. The maximum speed is given by $\left[\frac{K_s}{W}\right]^{1/2}$ according to Eq. (57) of "Shafts from a Dynamic Viewpoint", since

$$K = \frac{32\,I}{L^3} = \frac{3(2.6)(10^6)(\pi)(1.125)^4}{64(144)^3} =$$

$$\frac{7.6(10^6)(\pi)(1.57)}{64(2.72\times10^6)} = 2210\ \#/in$$

Hence,

$$\left[\frac{K_s}{W}\right]^{1/2} = \left[\frac{2210(32.2)}{1.0\times17}\right]^{1/2} = \left[6{,}510\right]^{1/2} = 81\ \text{radians per sec}$$

Key

$$f = \frac{c}{\frac{w_1}{w_2} - 1}$$

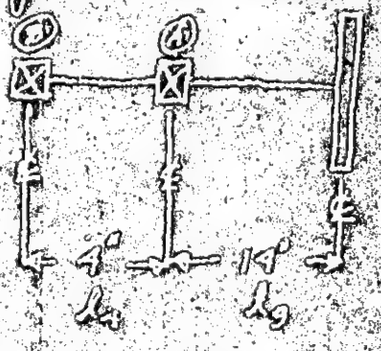
as for Eq. (50) of "Keying for a Bypass Fit",

$$f = \frac{c}{\left(\frac{2.5}{2.5}\right) - 1} = \frac{c}{2.5 - 1} = \frac{c}{1.5}$$

and since $c = 0.015''$, k_1

$$f = \frac{0.015}{1.5} = .0039''$$

The keys in the first spacing, the keys and keyways = about a 4" spacing (center to center distance) between the two gear keyways.



The computed keying arrangement, with a shear of 15,000 psi, will allow .035" clearance under such a load, without shearing the keys. The moment that such a load would be:

$$M = SZ = S\pi d^3/32 =$$

$$\frac{15,000(\pi)(1.035)^3}{32} = \frac{15,000(\pi)(1.1)^3}{32} =$$

$$1650 \text{ in-lbs}$$

Taking moments about (2),

$$\frac{M}{l_3} = \frac{1650}{7} = 235\# = \text{load on key (3)}$$

Taking moments about (3),

$$\frac{M(l_3+l_2)}{l_3\ l_2} = \frac{1650(7+14)}{7(14)} = 350\# = \text{load on key (2)}$$

The formulas used with the principal computations found above will be repeated with following each part of the keyway computations.

20th Type Color Wheel for Black & White & Color TV

Let us consider a drum composed of 6 slots (a series of the same) and let us assume that the drum will be used for a 20" tube and will have

$$1.25h = l$$

Thus

$$(1.25h)^2 + h^2 = 20^2$$

$$h^2 = \frac{400}{2.56} = 156.2$$

$$h = 12.5"$$

$$l = 1.25(12.5) = 15.6"$$

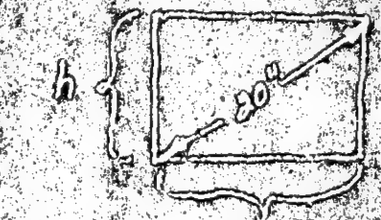


Fig. I

would be the dimensions of the tube. Now we must select the "cone" the picture would be occupying that

$$\frac{12.5}{\sin 60} = \frac{12.5}{.5} = 12.5" = \text{radius}$$

of the drum.

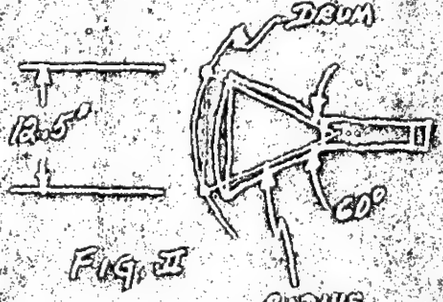


Fig. II

Let us now put the drum formed in the previous drawing in Fig. 3, in which the slots are covered with number "fifty" tape to reduce stray light. The slots, now consist of 10 slits, each 1/2" wide, and their lengths will be 17", thus the disk would have a volume of

$$2\pi r l \left[\frac{\theta}{360}\right]^{\circ} = \frac{2\pi(12.5)(17)(60)}{360} = 139.7 \text{ in}^3$$

and a specific gravity of 1.18, so

$$\frac{62.5 \frac{\text{lb}}{\text{ft}^3}}{1728 \frac{\text{in}^3}{\text{ft}^3}} \cdot 1.18 \cdot 139.7 \text{ in}^3 = 5.75 \text{ lb}$$

would be the weight of each slot, when

62.5 lb/ft³ is the density of water

In the standard CBS color disc, 9 discs (3 each for primary colors) are at 4410 rpm. This would be a speed of

$$\frac{1}{6}(4410) = 2210 \text{ rpm for the 6-slot drum}$$

The maximum torque for engine A is of

$$\frac{1400\ \frac{\text{rev}}{\text{min}} \left(2\pi\ \frac{\text{rad}}{\text{rev}}\right)}{60\ \frac{\text{sec}}{\text{min}}} = 150.8\ \frac{\text{rad}}{\text{sec}}$$

The centrifugal force acting on each shaft would then be

$$F_c = \frac{W}{g} v^2 r$$

$$= \frac{0.77\ \text{lb}_m}{32\ \frac{\text{ft}}{\text{sec}^2}} \left[150.8\ \frac{\text{rad}}{\text{sec}}\right]^2 \frac{13.5\ \text{in}}{12\ \frac{\text{in}}{\text{ft}}}$$

$$= 7140\ \#$$

and both rotating masses would therefore be acted upon by a load of

$$2(7140\ \#)\left(6\ \frac{\text{shafts}}{\text{wheel}}\right) = 8640\ \#$$

by the end

$$\frac{2(7140\ \#)}{\text{wheel}} = 1320\ \frac{\#}{\text{wheel}}$$

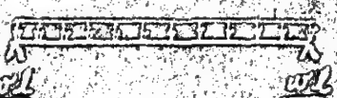
If both the female shafts in each wheel are to be of a material with a value of $70{,}000\ \#/\text{in}^2$ with a $2\frac{1}{2}$ to 1 safety factor, we have

$$\frac{1320\ \#}{0.75\ \text{in}.(t)} = 14{,}700\ \frac{\#}{\text{in}^2}$$

$$\frac{1320\ \#}{0.75\ \text{in}.(14{,}700\ \#/\text{in}^2)} = 0.125\ \text{in} = t$$

Each ring of the shaft must also be examined as a uniformly loaded beam which is simply supported at both ends:-

$$W = wl$$



$\frac{wl}{2}$ $\frac{wl}{2}$

Fig. 10.1

$$M = \frac{wlx}{2}(l-x) = EI\left(\frac{d^2y}{dx^2}\right)$$

$$\frac{w}{2}(lx - x^2) = EI\left(\frac{d^2y}{dx^2}\right)$$

$$\frac{w}{2EI}\left(\frac{lx^2}{2} - \frac{x^3}{3}\right) + C_1 = \frac{dy}{dx}$$

But $\frac{dy}{dx} = 0$, when $x = \frac{l}{2}$, and so:-

$$\frac{w}{2EI}\left(\frac{l^3}{8} - \frac{l^3}{24}\right) + C_1 = 0$$

$$C_1 = -\frac{w}{2EI}\left(\frac{l^3}{3}\right) = -\frac{wl^3}{24EI}$$

so that

$$\frac{dy}{dx} = \frac{w}{2EI}\left(\frac{lx^2}{2} - \frac{x^3}{3}\right) - \frac{wl^3}{24EI}$$

$$y = \frac{wx}{24EI}\left(\frac{L^3}{6} - \frac{x^3}{12} - \frac{L^2x}{12}\right) + C_2$$

But, since $y = 0$ when $x = 0$, then

$$C_2 = 0$$

and

$$y = \frac{wx}{24EI}\left(\frac{L^3}{6} - \frac{x^3}{12} - \frac{L^2x}{12}\right)$$

At $x = \frac{L}{2}$, the slope, that (y) would have its maximum value, and (y) would be given by:

$$y_{max} = \frac{wx}{24EI}\left(\frac{L^3}{8} - \frac{L^4}{192} - \frac{L^3}{24}\right)$$

$$= -\frac{5wL^4}{384EI} = -\frac{5WL^3}{384EI}$$

The figure is a form for computing the deflection and the stress, for the table when the shafts have the full given speed. It is necessary to develop the value of (I) for the shaft.

Fig. II

It is also found the mean radius between $r = 1\frac{1}{2}$" and $1\frac{1}{2}$" (which would be $1\frac{1}{2}$") would be the centre of gravity of the shaft considered as a ring. It would represent the area of the two circular end pieces of the shaft as approximately

$$\frac{\pi(2\pi r_{mean})^2 x}{360} =$$

$$\frac{\pi}{\pi}\frac{(2\pi)(1\frac{1}{2})(60)}{360} = 0.82 \text{ in.}$$

y_0 (II) would depend to the x^2 value would be

$$A_0 = 0.82\left(1\frac{1}{2}\right)^2 = 1.84 \text{ in.}$$

The centre of gravity of the shaft would be given by:

$$y_0 = \frac{r_{mean}\sin\theta}{\text{area}\ \theta}$$

$$= \frac{(1\frac{1}{2})(\sin 30°)}{\text{area}\ 30°} = \frac{1\frac{1}{2}\left(\frac{1}{2}\right)}{0.5236} = 1.45$$

$I_{(I_0)}$ is the moment of inertia of the beam section about its own center of gravity, thus

$$I_{dg} = I_0 + Ad^2$$

and for

$$12.1 \text{ in}^4 = I_0 + 0.832(11.75)^2$$

$$I_0 = 0.832(7.5) = 12.1 - 11.75 = 0.35 \text{ in}^4$$

From this, it follows that

$$\text{for max. } \delta = \frac{5wL^4}{384EI} = \frac{5(1.10)(17)^4}{384(3)(10^6)(11.5)} = 0.0112 \text{ ft}$$

which is acceptable if the above unit loads are assumed to be uniformly distributed

$$\text{for max. } \theta = \frac{wL^3}{24EI} =$$

and

$$M_{max} = \frac{wL^2}{8} = \frac{WL}{8}$$

therefore

$$\text{for max. } \theta = \frac{WL}{8} \cdot \frac{L^2}{24EI} = \frac{5wL^3}{192EI}$$

but

$$M = SZ$$

where

M = moment resisted in the beam = in-lbs
Z = section modulus of the beam = in^3
S = stress resisted in the beam = lbs/in^2

and

$$\frac{I}{c} = Z$$

where

c = distance of the extreme fiber from the neutral axis of the beam

and therefore

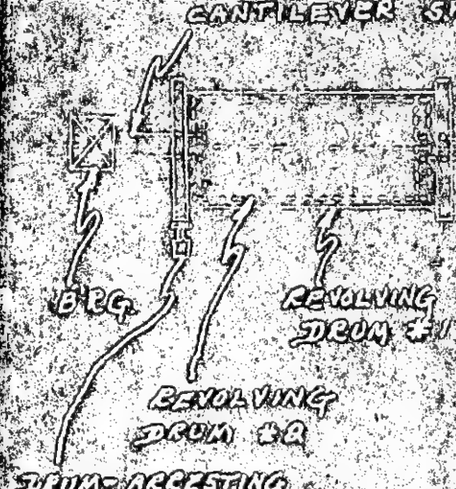
$$\text{for max. } \theta = \frac{S\left(\frac{I}{c}\right)L^2}{24EI} = \frac{SL^2}{24Ec}$$

By this equation:

$$0.0112 \text{ in} = \frac{\left(\frac{5(11.5)}{(17^2)}\right)S}{24(3)(10^6)} = \frac{5(10^{-2})(17^2)S}{72(10^6)(1.032)}$$

$$\frac{1.032(0.0112)(72)(10^6)}{5(10^{-2})(17^2)} = S = \frac{3.38}{\text{in}^2} \text{ lbs}$$

NOTE:- DRUM #2 TO CONSIST OF 5 COLOR FILTERS, AND 1 WHITE LIGHT SLAT. DRUM #1 5 WHITE LIGHT SLATS AND 1 COLOR SLAT COMPLETING 2 SERIES FOR DRUM #2

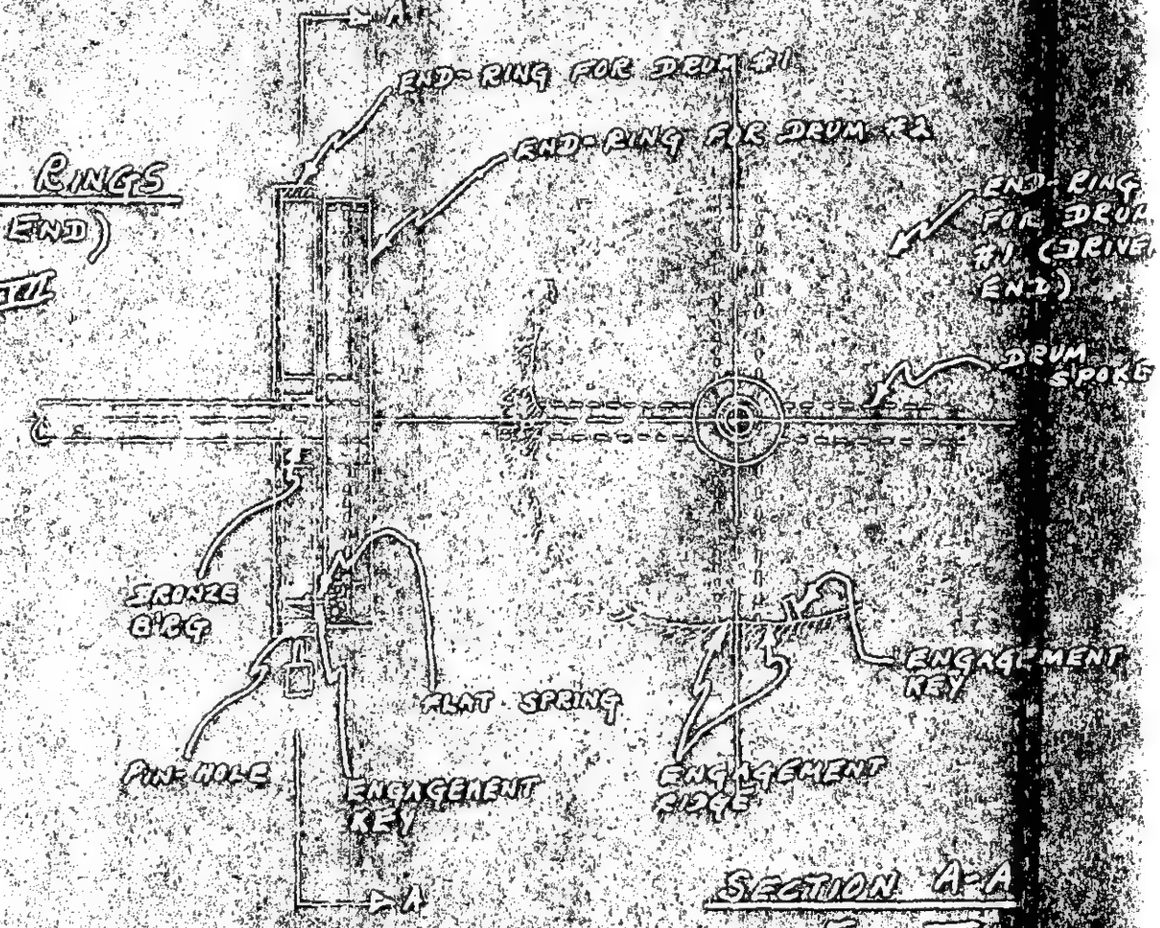


GENERAL ARRANGEMENT OF DRUM SUPPORT

FIG. II

DRUM RINGS (DRIVEN-END)

FIG. III



SECTION A-A

FIG. III

The approximate flywheel energy weight of the 9-cam, 4-lobe would be as follows:

Cam radius = 1.7" (given)

$$\frac{2\pi r\theta}{360} = \frac{2\pi(2.5)(60)}{360} = 2.6" \text{ arc}$$

and .76" flank

would weigh

$$\frac{12.5(174)(3.1)(0.26)(.57)(62.5)(0.18)}{1728} = 7.17\#$$

and, if we estimate each push-rod as 3#, plus the cam-gear would weigh 15# in total, it gives a total weight of approximately 20#. This could be used to have a radius of gyration of approximately 15", giving the Drum a Σmr^2 of -

$$\Sigma mr^2 = 20\left(\frac{15}{12}\right)^2 = 23.5 \text{ lb-ft}^2$$

For such a drum to attain a velocity of 150.8 $\frac{\text{radians}}{\text{sec}}$,

$$\frac{23.5}{2(32.2)}(150.8)^2 = 16,700 \text{ ft-lbs} = 8,350 \text{ ft-lbs.}$$

of energy is required in the form of flywheel energy. Such a wheel, however, is large enough, and it would be desirable to reduce the requirement to ½ or less of the indicated figure. For an 8-lobe cam, the weight of the drum, more particularly the weight at the indicated radius of gyration, by setting a 3# limit for the 4-cut-ways in total. In that case,

$$\frac{10.47}{32.2}(141.7) = \frac{234.0}{32.2} \text{ ft-lbs.} = 3620 \text{ ft-lbs.}$$

would be the required flywheel energy, and if the cam supplied in 60 secs.

a

$$\frac{3620 \text{ ft-lbs}}{(60 \text{ secs})\left(50.0 \frac{\text{ft-lbs}}{\text{min-H.P.}}\right)} = 0.105 \text{ H.P.}$$

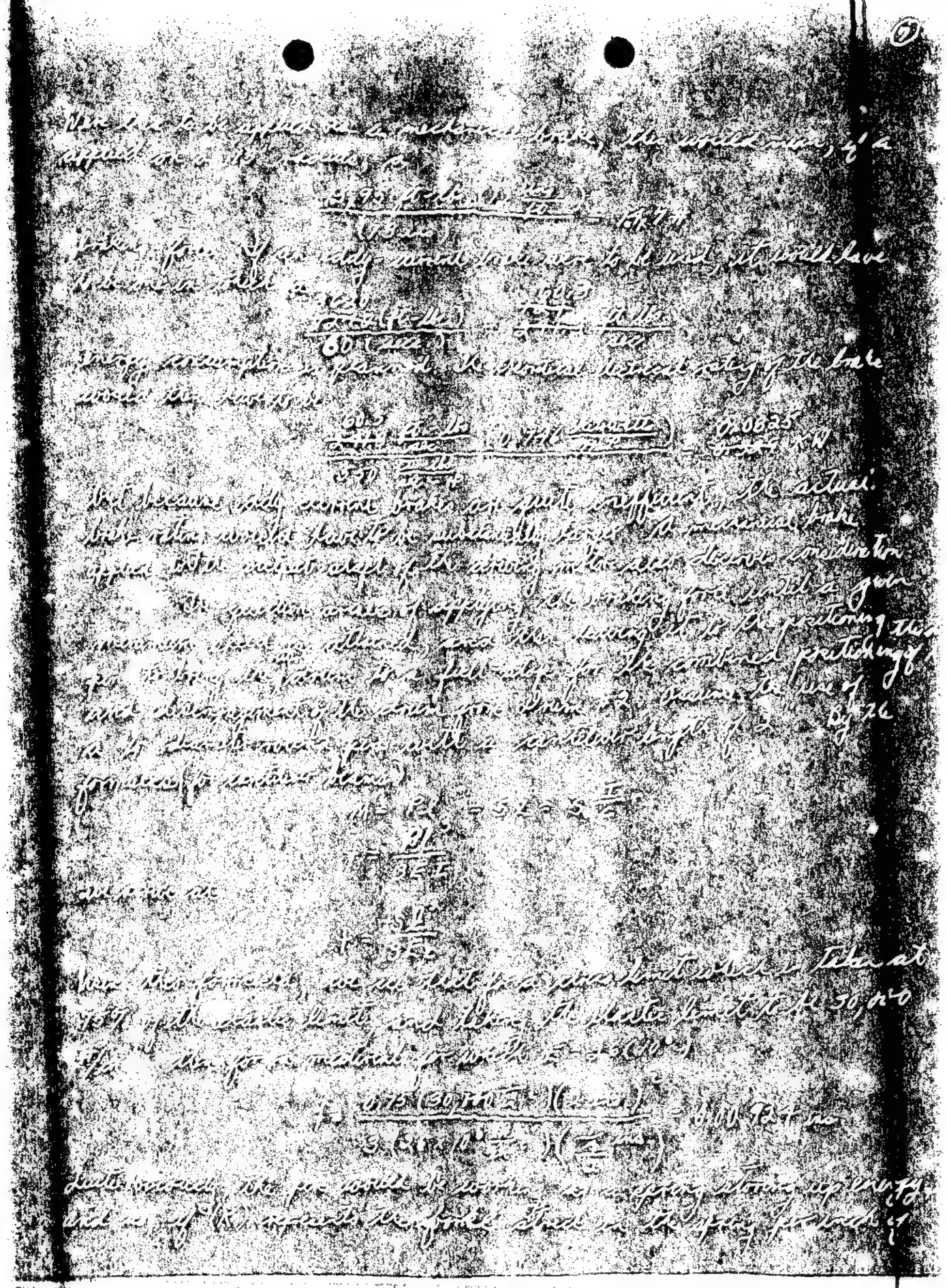
motor-drive would be required.

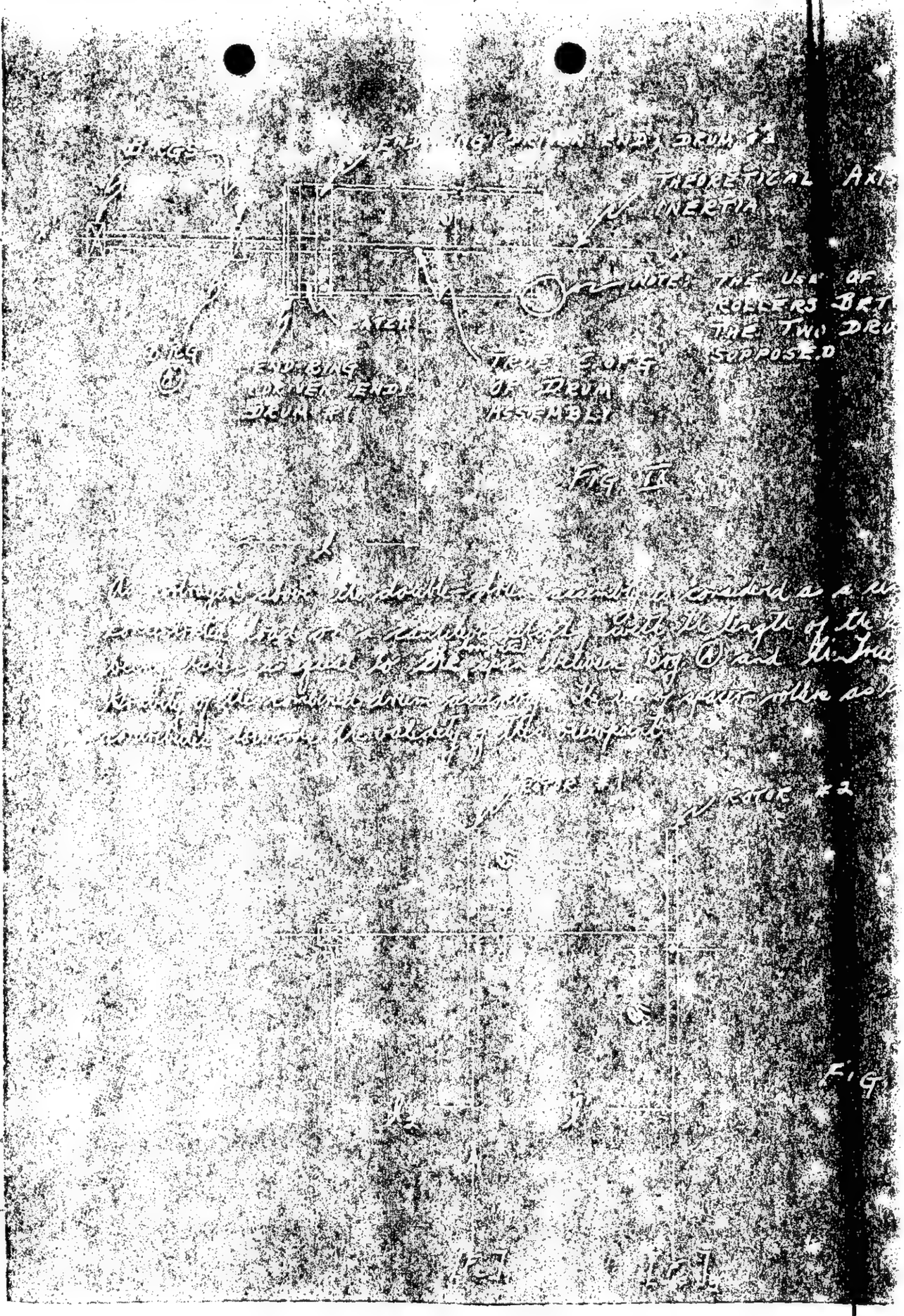
In keeping the Drum-Assembly to a slip, let us assume that 60 secs. is adjusted. Then the angular acceleration of

$$\alpha = \frac{\Delta V}{t} = \frac{2(150.8-0)}{60} = 5.03 \frac{\text{radians}}{\text{sec}^2}$$

is entailed, and the torque-ability of the Cam would have to be

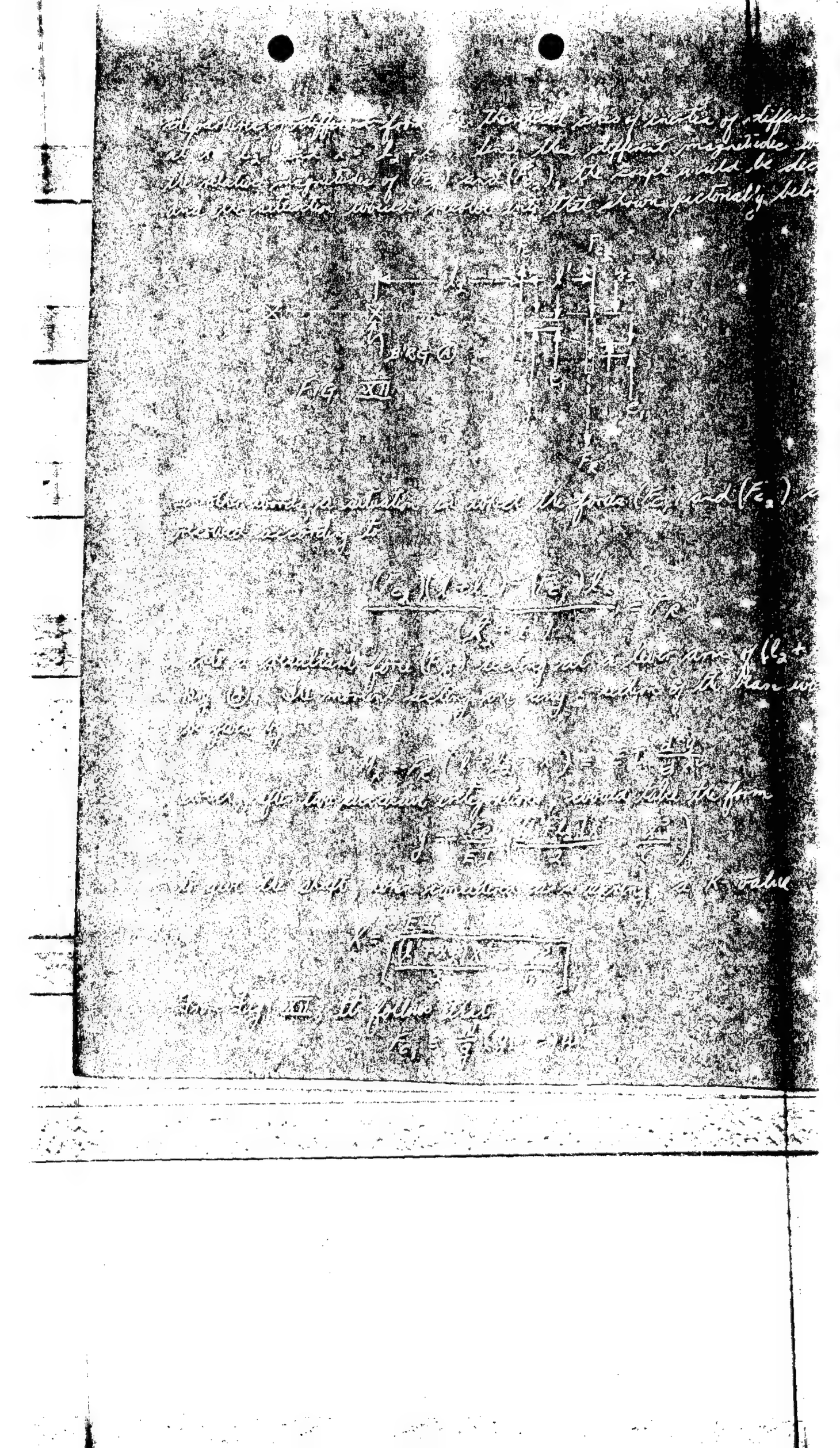
$$\frac{10.47}{32.2}(5.03) = \frac{1.635}{32.2} \text{ ft-lbs.}$$

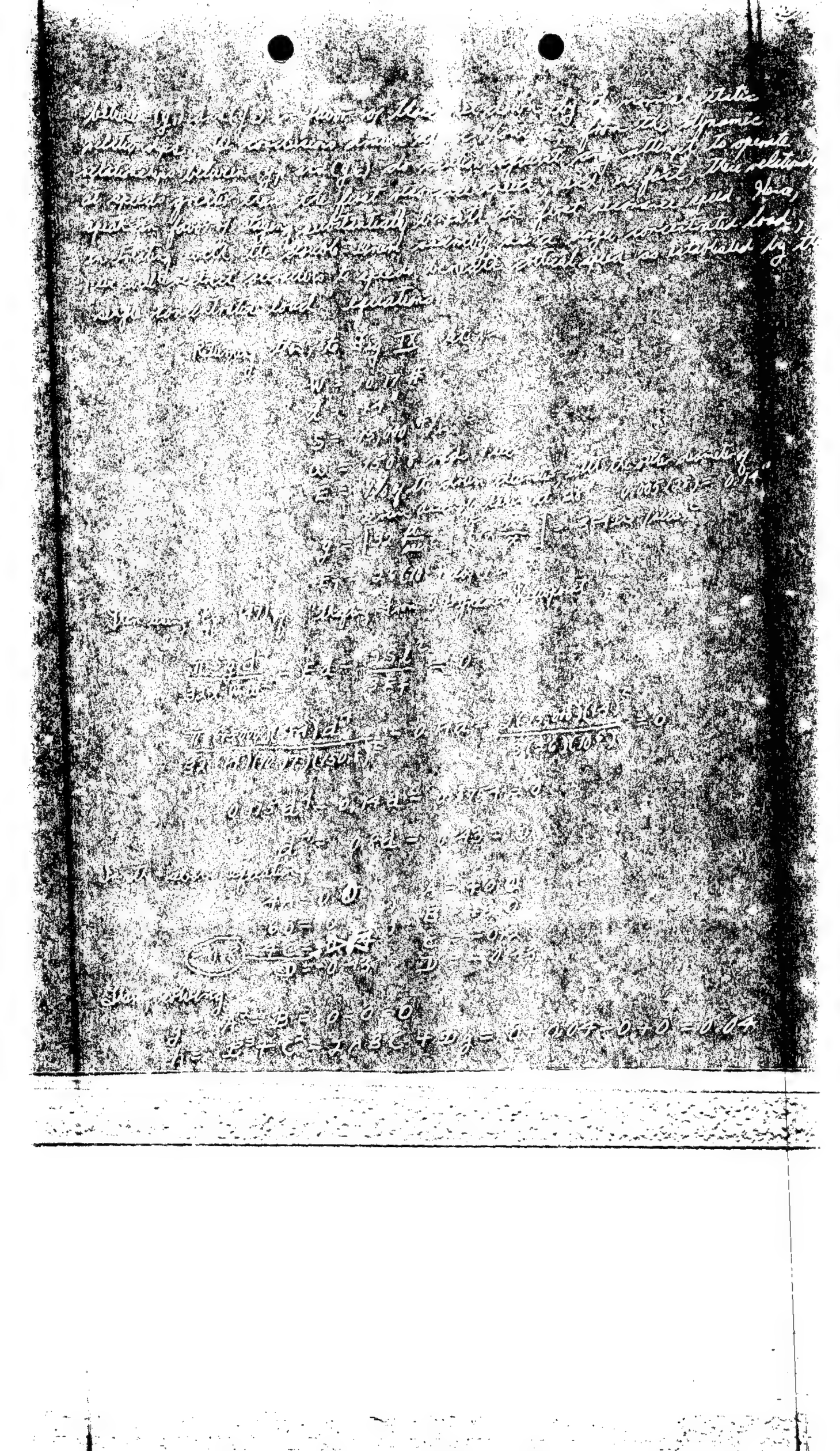



THEORETICAL AXI
INERTIA
FIG II
RATIO #2
FIG

$$\frac{W}{g}$$

$$\frac{W}{g}$$





$$\left[\frac{}{}\right]^{1/5} = 22.7 \left[\frac{}{}\right]^{1/5} =$$

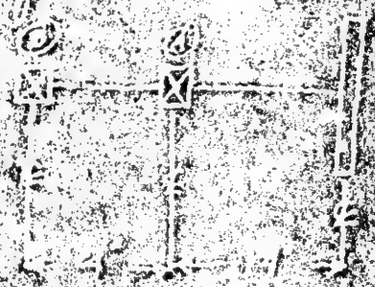
$$\left[\frac{}{}\right]^{1/5} = 0.27 (\quad) = 0.321''$$

$$\frac{}{} = S_c$$

$$\left[\quad + \quad\right]^{1/2} = \left[\quad\right]^{1/2} =$$

$$\left[\frac{}{}\right]^{1/2} = \left[\quad\right]^{1/2} = 9.14 \text{ cycles}$$

per 2 π sec.



CRT TYPE FOR BLACK & WHITE & Color TV

$$y = \left(\frac{L}{2} x - \frac{x^2}{2} \right) \frac{w}{EI} + C_1 x + C_2$$

But, since $y = 0$ and $x = 0$, then

$$C_2 = 0$$

And

$$y = \frac{w}{EI} \left(\frac{Lx^3}{6} - \frac{x^4}{24} \right)$$

Or, $x = \frac{L}{2}$, where y is a maximum value, and

$$y = \frac{w}{EI} \left(\frac{L}{4} - \frac{L^4}{24} \right)$$

$$= \frac{5wL^4}{384EI}$$

[illegible] the selected [illegible] to develop [illegible]

[illegible] between [illegible] which would [illegible] the [illegible] of [illegible]

Part II

$$= \frac{(\quad)(\quad)(\quad)}{(\quad)} = 0.823 \text{ in.}$$

[illegible] axis

$$y = \frac{\quad}{\quad}$$

$$= \frac{(\quad)(\quad)}{(\quad)} = 1.95$$

NOTE:- DRUM #2 TO CONSIST OF 5 COLOR FILTERS AND 1 WHITE LIGHT SLAT. DRUM #1 4 WHITE LIGHT SLATS AND 1 COLOR SLAT COMPLETING 1 SERIES FOR DRUM #2

CANTILEVER SHAFT

BOLT

GENERAL ARRANGEMENT OF DRUM SUPPORT

FIG. VI

END-RING FOR DRUM #2

END-RING FOR DRUM #2

END-RING FOR DRUM #1 (DRIVE END)

DRUM SPOKE

ENGAGEMENT KEY

ENGAGEMENT KEY

SECTION A-A

FIG. VII

the approximate weight of the drum, [illegible] as follows:

[illegible] = 17 lbs.

$$\frac{2\pi \cdot 60}{360} \cdot \frac{2\pi (26.5)(60)}{362} = 13.1 \text{ lbs.}$$

[illegible] Steel

$$\frac{\pi (17)^2 \cdot D (0.28)(5)(12^3) - (0.28)}{1728} = 1.17 \text{ lbs.}$$

[illegible] the drum [illegible] weight of [illegible] number of [illegible]

$$D\left(\frac{1}{2}\right) = [illegible]$$

[illegible],

$$\frac{[illegible]}{2}(12 \times 1)^2 = [illegible] \text{ lbs} = 3.10 \text{ ft-lbs.}$$

[illegible] the [illegible] the requirement to [illegible] the weight of the [illegible] by [illegible]

$$\frac{[illegible]}{2}\left(\frac{1}{10}\right) = \frac{[illegible]}{2} \text{ ft-lbs} = 3620 \text{ ft-lbs.}$$

[illegible] will have supplied in 60 sec.

[illegible]

[illegible] assume that

[illegible]

[illegible]